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CHT SHIP/SHORE OPERATIONS ASSESSMENT. VOLUME II. APPENDIX B,(U)
DEC 78 R W URBAN, P E CARR, S H SCHWARTZ N00014-78-C-0345
UNCLASSIFIED NL

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CHT
SHIP/SHORE OPERATIONS ASSESSMENT

VOLUME II

APPENDIX B

DECEMBER 1978

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PROFESSIONAL ENGINEERS

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2

6 CHT

SHIP/SHORE OPERATIONS ASSESSMENT . VOLUME II . APPENDIX B

by

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CONTRACT NUMBER: 15 N00014-78-C-0345

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12 143 p.

11 8 December 1978

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SHIP: USS RICHARD E. BYRD (DDG-23) **PORT:** Norfolk

DATE: 22 Jun **TO** 26 Jul 78

SHIP CLASS ADAMS class DDG

CHT SYSTEM

Strainer type
2 independent systems; fore and aft tanks with 2 deck risers each
Peabody- Barnes pumps rated 150 gpm at 70 feet head
Mercury float level sensors

CERTIFICATION

Provisionally certified by COMNAVSURFLANT letter 4 April 1978

OPERATING STATUS

Holding tanks and discharge pumps operating as of 30 May 1978

INSTALLATION **DATE** 1975
YARD Norfolk Naval Ship Yard

CREW SIZE **AT SEA** 305
IN PORT 250

SHIP: USS RICHARD E. BYRD (DDG-23)

TEST PREPARATION

The RICHARD E. BYRD (DDG-23) was boarded on 22 May,1978 to activate the CHT system and collect data on ship sewage collection. An introductory meeting was held with the repair division to familiarize them with the CHT system operation. The system had a SDOSS which was used to trace piping, locate valves and establish operation procedures.

The activation of the CHT system was hindered by two main problems . The aft pump controller and level sensors had several interrelated electrical problems that took several days to trace and repair. The forward CHT tank inflow stop valves required removal and repair.

The system was activated with salt water flushing. Grey water was then diverted to the tank and finally,black water was diverted. In this way the crew became familiar with the location and setting of all diverter valves and gained confidence in the system. The procedures for a safe sewage transfer hose disconnection were demonstrated.

Event counters, 110 volt, were installed on each pump control relay to record pump use and calculate the volume of sewage pumped to shore. With this data regularly recorded by the ship's watch, a curve of sewage collection rates was calculated. Data was collected in port for a base line curve while all drains were diverted to the tank. At sea, data was collected with only black water soil drains diverted to the tank as in a transiting mode. In port, data was also collected with laundry drains diverted over the side and for several days when the tank was continually being flushed.

SHIP: RICHARD E. BYRD (DDG-23)

SYSTEM REPAIRS

VALVES & PIPING

Both inflow stop valves in the forward CHT tank room were frozen. Valves 4-44-6 and 4-44-8 were removed and repaired. New handles were fabricated to replace the broken cast iron handles.

ELECTRICAL

The aft motor controller relay was found corroded from a water leak through a cable packing nut. The relay was removed and repaired. Broken level sensor wires were found to be shorting out the controller.
The electrical sump pumps in both pump rooms were not working. A fuse was replaced in the forward control box and the pressure switch repaired in the aft sump pump.

LEVEL SENSORS

The aft 10% and 30% mercury float level sensors were found with cut insulation. The movement of the sensor in the tank had caused the wire insulation to be worn away where it passed through the tank wall. The hole drilled in the tank wall is only ½" which requires the entering of the tank to change the 3½" diameter sensor. Also, the 10% level sensor was hung too low into the tank and would not shut off the pumps at low water.

PUMPS

The forward pump room #2 pump was found with a bad bearing in the motor. The motor seized after a few days of operation. The bearing will be replaced by ship's force during the extended deployment. The system operated satisfactorily with one pump.

ALARMS

Both high level alarms had been previously replaced by ship's force. Alarms were found not functioning because they were not reset in D.C. central.

SYSTEM DOCUMENTATION

SDOSS valve numbering of the forward salt flushing valves was incorrect. Tank Drain Valves and Lines are incorrectly shown. This line functions as a discharge line drain. (see the appendix for details)

SHIP: USS RICHARD E. BYRD (DDG-23)

OPERATING SUMMARY

The BYRD's CHT system operates normally in the automatic mode for transfer to shore sewers. There are several operating characteristics which should be noted.

The saltwater flushing connection to the pump discharge piping is not yet installed. Flushing of this line and sewage transfer hose is accomplished by flushing the CHT tank with salt water through the washdown fitting. This flushing method is inadequate for cleaning sewage transfer hose prior to disconnecting. Until the SHIPALT is accomplished to provide a direct salt water firemain flushing connection, care should be taken to avoid spills when disconnecting sewage hoses. PWC should be notified that the hose has not been directly flushed with salt water.

High level tank alarms sound in the pump rooms and in D.C. Central. While in port, D.C. Central is not continuously manned. Pump rooms should be checked hourly for alarms. In the event of power failure, alarms must be reset in D.C. Central and the pump controllers reset in each pumproom.

Pump discharge overboard diverter valves are in the deck riser discharge piping. If an outboard nested ship is pumping through, and the diverter valve is aligned to overboard for some reason, it will prevent the outboard ship from pumping to shore.

The laundry drains are located below the CHT tank emergency overflow. If the CHT tank backs up, the laundry space may be flooded despite the check valves installed in these lines. While holding black water during transiting to or from sea, the laundry should be diverted overboard to prevent accidental back up.

SHIP: USS RICHARD E. BYRD (DDG-23)

FROM: 31 May 78

WASTEWATER GENERATION DATA

TO: 12 June78

SHIP STATUS In port - 250 men

TEST METHOD Wastewater volume was calculated by tank volume measurements and pump event counters on each discharge pump.

VOLUME REDUCTION ADJUSTMENT

Both soil and waste drains were diverted to the CHT tank for normal in port collection to establish a normal system base line.

DATA

DATE	FWD gal	AFT gal	TOTAL gal	
31 May	4670	8585	13255	
2 June	5604	10164	15768	
3 June	5604	7623	13227	*
4 June	5604	7260	12864	*
5 June	4670	11616	16286	
6 June	4670	6897	11567	
7 June	4670	10527	15197	
10 June	3736	10527	14263	*
11 June	4042	16335	20377	*
12 June	5604	7986	13590	
AVERAGE	4887	9752	14639	

gpcd - 59

*weekend

Table 1

SHIP: USS RICHARD E. BYRD (DDG-23)

FROM: 19 June

WASTEWATER GENERATION DATA

TO: 23 June

SHIP STATUS At sea - 305 men

TEST METHOD Wastewater volume was calculated by tank volume measurements and pump event counters on each discharge pump.

VOLUME REDUCTION ADJUSTMENT

The CHT system was diverted to the Transit Mode and continued to collect only black water from the soil lines while underway. The pumps discharged through the overboard diverter valve.

DATA

DATE	FWD gal	AFT gal	TOTAL gal
19-23 June Daily Average	2093	6171	8264
			gpcd - 27

Table 2

SHIP: USS RICHARD E. BYRD (DDG-23)

FROM: 17 June 78

WASTEWATER GENERATION DATA

TO: 18 June 78

SHIP STATUS In port - 250 men

TEST METHOD Wastewater was calculated by tank volume measurements and event counters on each discharge pump.

VOLUME REDUCTION ADJUSTMENT

The data below shows the result of extensive tank flushing on daily wastewater generation.

DATA

DATE	FWD gal	AFT gal	TOTAL gal
17 June	3140	71511	74651
18 June	10676	38125	48801
AVERAGE	6908	54818	61726

gpcd - 247

Table 3

SHIP: USS RICHARD E. BYRD (DDG-23)

FROM: 24 June

WASTEWATER GENERATION DATA

TO: 27 June

SHIP STATUS In port - 200 to 250 men. Ship was preparing for an extended deployment.

TEST METHOD Wastewater volume was calculated by tank volume measurements and pump event counters on each discharge pump.

VOLUME REDUCTION ADJUSTMENT Laundry drains were diverted to discharge overboard. Volumes were reduced by changes in shipboard activity for smaller duty sections and shorter working days granted prior to an extended ship deployment.

DATA

DATE	FWD gal	AFT gal	TOTAL gal
24 June	3140	6171	9311
25 June	3140	5808	8948
27 June	3140	4356	7496
AVERAGE	3140	5445	8585

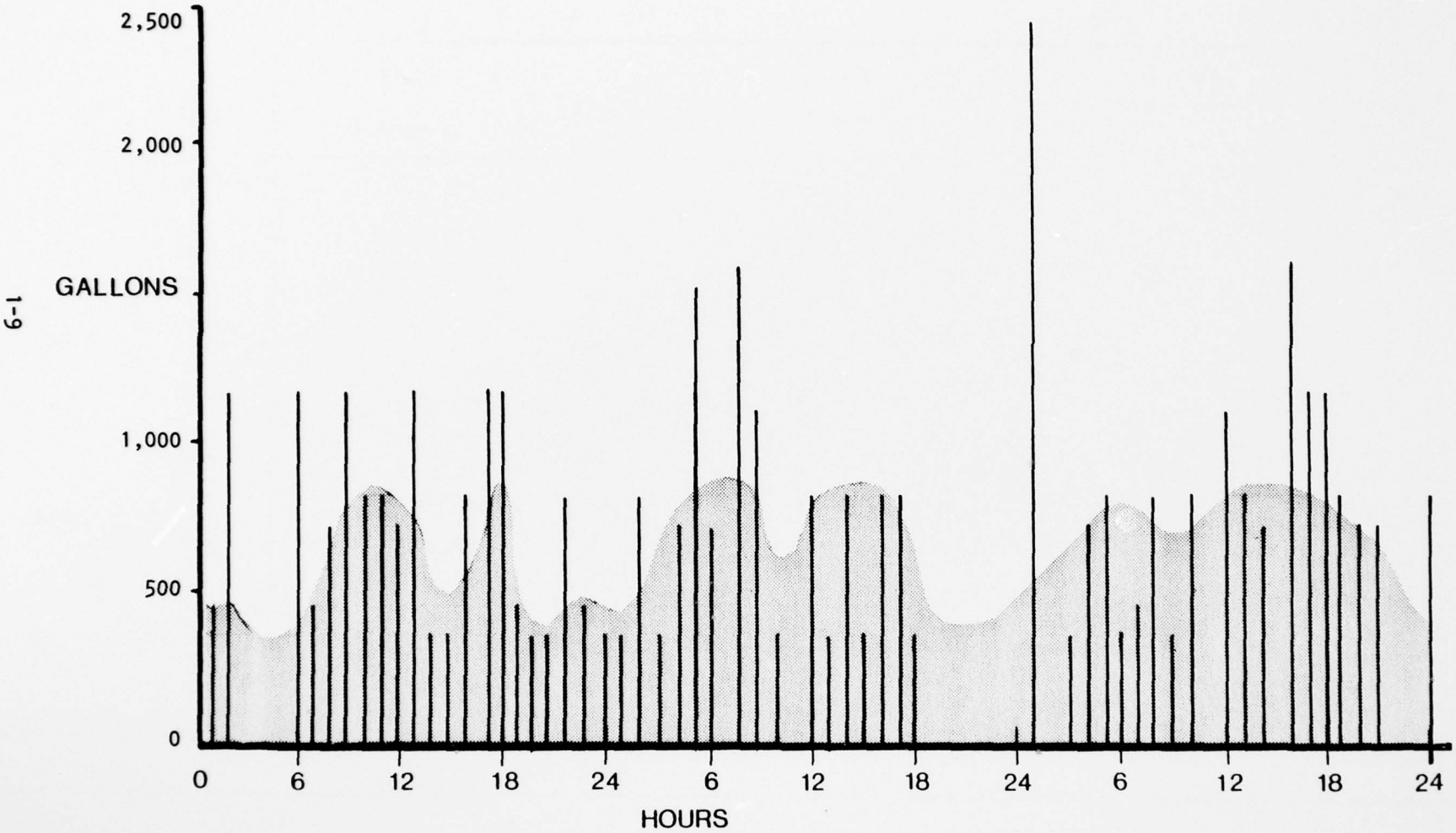
gpcd - 34

Table 4

SHIP: USS RICHARD E. BYRD (DDG-23)

FROM: 5 Jun 78

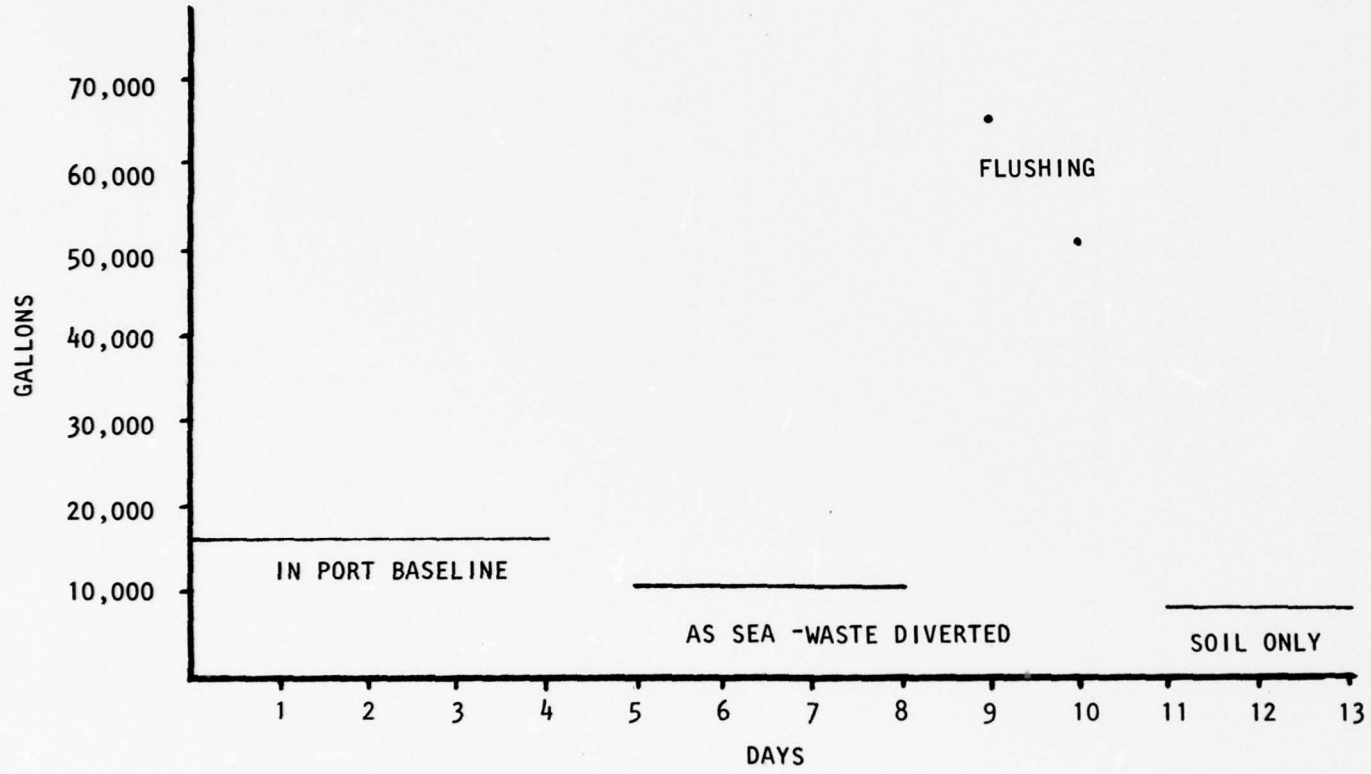
TO: 7 Jun 78



DIURNAL WASTEWATER GENERATION

FIGURE 1

SHIP: USS RICHARD E. BYRD (DDG-23)



DAILY WASTEWATER GENERATION AVERAGES

FIGURE: 2

SHIP: USS RICHARD E. BYRD (DDG-23)

CONCLUSIONS

Data was gathered from sewage collected in several operating conditions. These were baseline data with all drains diverted to the CHT tank, at sea data with only soil drains diverted to the tank, in port data with the laundry diverted over the side, and data showing high volumes from constant tank flushing.

Baseline data was gathered in port with all drains diverted to the tank. Ten days of data are shown in Table 1. The table shows the sewage pumped from the forward and aft systems. The total daily average for the system was 14,639 gallons for an average of 58.5 gallons per man day. The BYRD uses constant flushing on most of the urinal lines. However the total daily average is still very close to a design guidance of 60 gallons per man day and the quantity of sewage generated is normal for this ship and system configuration.

The diurnal graph of Figure 1 shows total gallons per hour pumped for 72 consecutive hours. The effect of constant urinal flushing is seen as a base of approximately 360 gallons per hour on the graph.

At sea, the CHT system continued to collect black water for the soil drains. Waste drains were diverted over the side as in the transit mode. The daily average of three days is shown in Table 2. In this mode the forward tank produced an average of 87 gallons per hour. The aft produced an average of 257 gallons per hour. At these rates the transit holding time until 85% tank level is:

Forward----------10.2 hours
Aft---------- 5.3 hours

The effect of constant flushing of the CHT tank is shown in Table 3. A daily average of 61,726 gallons was pumped to shore when the tank washdown was inadvertently left on for two days.

The data shown in Table 4 was collected for three days after the laundry drains were diverted over the side. Although the total average is considerably less than the baseline average, the difference is mostly attributed to changes in water use habits as the ship was preparing for extended deployment.

As each duty pump cycle is completed the following volumes are pumped:

DUTY VOLUME

Forward tank------306 gallons
Aft tank----------363 gallons

SHIP: USS RICHARD E. BYRD (DDG-23)

RECOMMENDATIONS

The daily generation of sewage by the BYRD, as collected by the CHT system, is not excessive for normal operation. The wastewater generated is within the design guidelines for 60 gallons per man per day, even with the urinal flushing valves set for a continuous flush to keep the drain lines clear. Care should be taken to insure that unnecessary sources of salt water be secured when not needed. The garbage grinder eductor, and the CHT tank flushing water line are two sources that can triple wastewater generation if left open. The valves for these and other similar sources should be tagged to warn the operator to secure them when not needed.

The CHT tank and the pump discharge system should be continuously used if possible while at sea or at a pier without a sewer. Operating the system with the pump discharge over the side will prevent sludge buildup, aid system maintenance and prevent deterioration of an idle system. Reactivating a CHT system after an extended deactivation is often difficult and time consuming.

The following system modifications should be considered to enhance CHT operation and maintenance. Some of these items may be included in pending SHIPALTS.

1. A connection should be made between the firemain saltwater flushing supply and the pump discharge piping to allow for the proper flushing of the sewage transfer hose. The salt water flushing line should be directly piped to the tank washdown fitting. This will simplify tank flushing.

2. Locate an additional CHT tank high level alarm on the Quarterdeck.

3. The holes in the tank wall for the level sensors should be enlarged so that the sensors can be removed without entering the CHT tank. The small holes presently drilled in the tank wall have sharp edges that cut through the sensor cable insulation and has shorted sensor cables. A full set of spare level sensors should be kept aboard.

4. Warning signs should be placed on the pump controller indicating that the panel has two sources of voltage. The panel has 440 volts for the pumps and controllers and a 120 volt source from the alarm circuit.

5. A warning light should be installed on the controller panel to indicate if the relays have been activated. This will give the watch a quick indication and warning if the controller relays have not been reset.

SHIP: USS RICHARD E. BYRD (DDG-23)

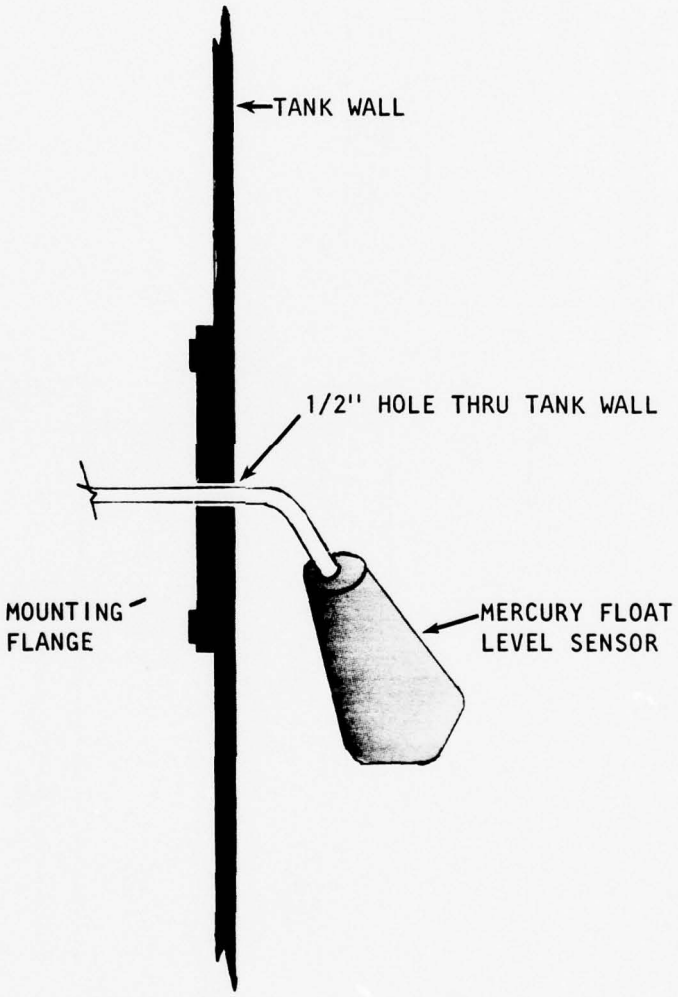
RECOMMENDATIONS

6. A local alarm cutout switch should be installed on each control panel to deactivate the alarm bell in the pumproom.

7. Corrections to the SDOSS manuals, as indicated in the following appendix, should be made to all shipboard copies.

SHIP: USS RICHARD E. BYRD (DDG-23)

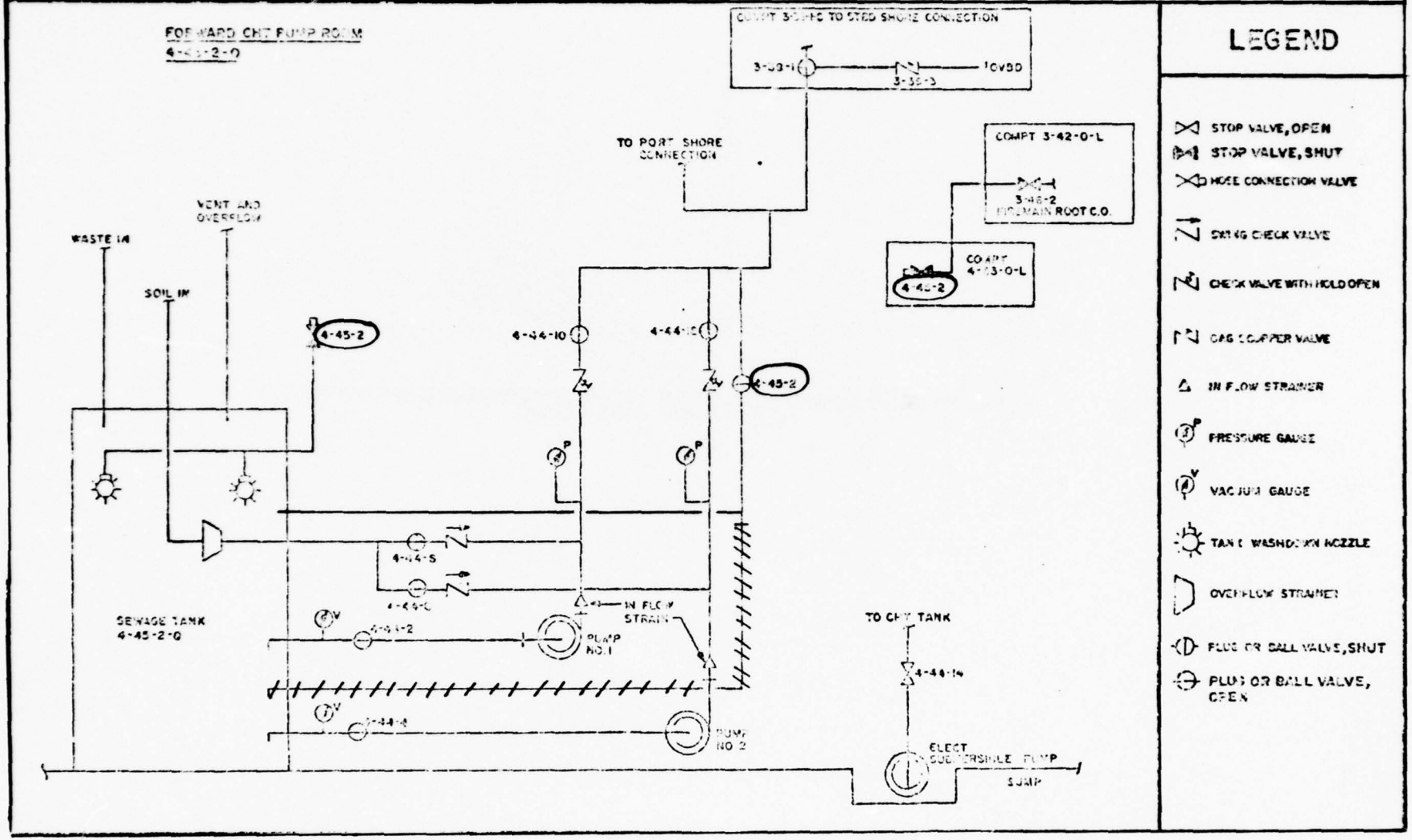
APPENDIX



LEVEL SENSOR INSTALLATION
CROSS SECTION

DIAGRAM FOR SEWAGE DISPOSAL PUMP ROOM IN-PORT PIPING ALIGNMENT

DPRI

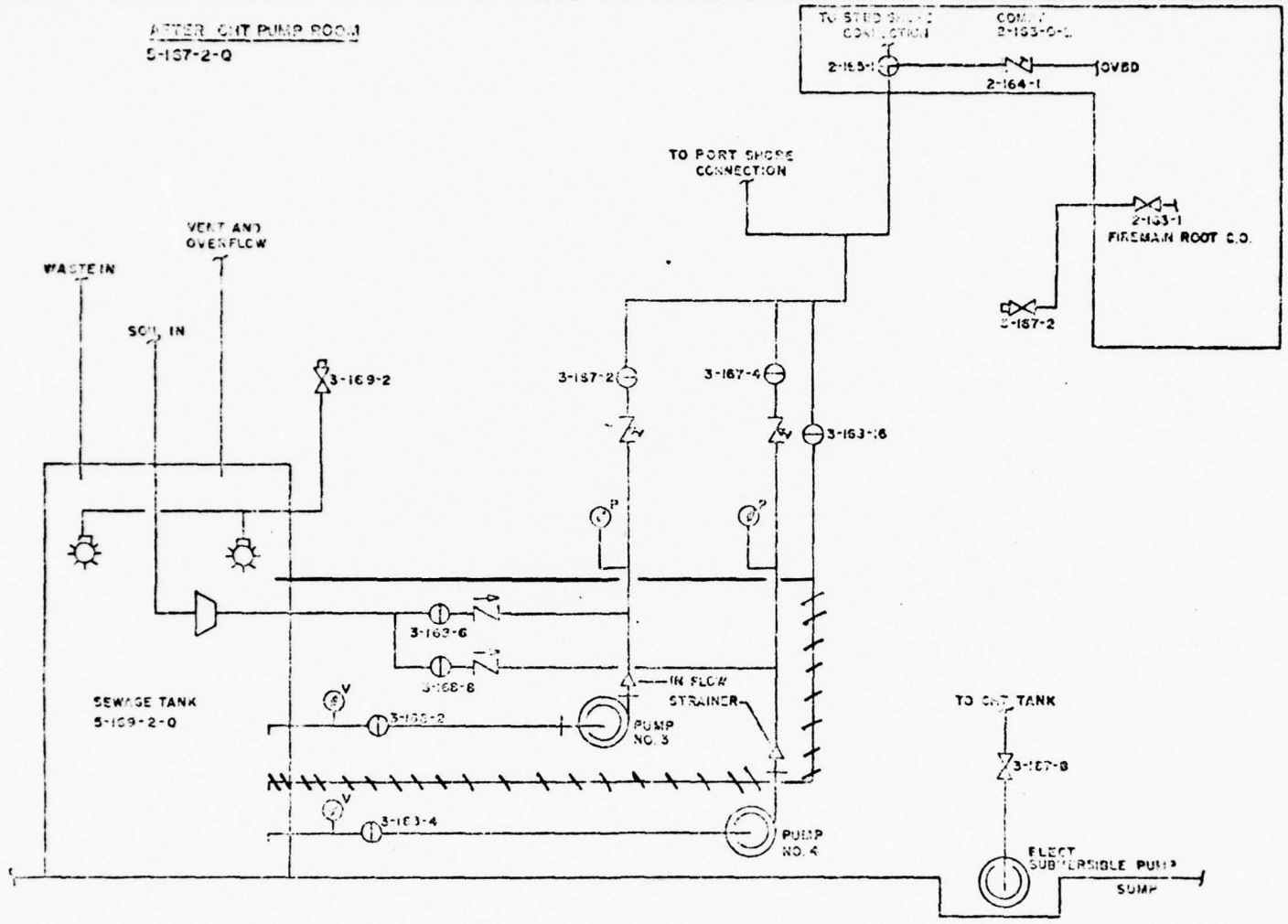


LEGEND

- STOP VALVE, OPEN
- STOP VALVE, SHUT
- HOSE CONNECTION VALVE
- SWING CHECK VALVE
- CHECK VALVE WITH HOLD OPEN
- GAS COPPER VALVE
- IN FLOW STRAINER
- PRESSURE GAUGE
- VACUUM GAUGE
- TANK WASHDOWN NOZZLE
- OVERFLOW STRAINER
- PLUG OR BALL VALVE, SHUT
- PLUG OR BALL VALVE, OPEN

DIAGRAM FOR SEWAGE DISPOSAL PUMP ROOM PIPING

DSPR



SHIP: USS BLANDY (DD-943) **PORT:** Norfolk

DATE: 5 Jun **TO** 7 Jul 78

SHIP CLASS

FORREST SHERMAN class w/ASW Mods

CHT SYSTEM

Strainer type
2 independent systems, fore and aft tanks with 2 deck risers each
Peabody-Barnes pumps, 150 gpm, at 70 feet head
Diaphragm level sensors
Laundry is not piped into either CHT tank
Urinals are continuously flushed

CERTIFICATION

Provisionally certified by COMNAVSURFLANT letter 23 January 1978

OPERATING STATUS

Holding tanks and discharge pumps operating as of 19 June 1978

INSTALLATION

DATE July 1976
YARD Bethlehem Steel, Boston, Mass

CREW SIZE

AT SEA 300
IN PORT 275

SHIP: USS BLANDY (DD-943)

TEST PREPARATION

The USS BLANDY was boarded 6 June 1978 to activate the installed CHT system and to collect sewage generation data. An introductory meeting was held with the Officers and key "A-division" personnel to introduce the project and to familiarize them with the CHT system operation. The rest of A and E division personnel were briefed later due to a scheduling problem. The SDOSS was aboard and was used to trace the piping system and to check and align the system's valves.

There was a delay in activating the system because of level sensor problems which required several days to remove and repair. A ship's move also delayed the activation.

After the repairs to the level sensors were accomplished, the system was activated using salt water from the flushing main to check for the proper control and system operations. This test ran for a 24 hour period. After a successful check, the soil and waste drains were diverted to the tank and the system was activated.

The sewage was diverted to the CHT tank and pumped over the side from the CHT tanks because the BLANDY was berthed outboard a ship that did not have a system installed. A hose handling instruction session was held for the benefit of the personnel who would be handling the hose, so that they would know the proper procedures.

Electrical event counters were installed on each pump controller to record pump usage and by calculating the tank volume at each pumping, a value for the amount of sewage pumped off the ship was determined. Also, due to regular ship's force data collection, a pattern of generation was established.

After a base generation rate was determined with all grey and black water going to the tanks, the grey water was diverted over the side to obtain a base black water generation rate. Since there are no provisions for piping the laundry drains to the CHT tank, there is no way to determine the effects of laundry waste water generation on the CHT system.

SHIP: USS BLANDY (DD-943)

SYSTEM REPAIRS

VALVES & PIPING

Five isolation valves are missing on the waste lines: one in the forward system, valve 3-63-3; four in the after system, valves 2-142-2, 2-141-1, 2-150-3, 2-149-2. The valves are onboard, but ship's force has to fabricate spool spacer pieces to be used with the valves when they are installed.
All piping runs are in good condition.
The shore/overboard diverter valve (2-147-5) leaked and required repacking to stop the leak.
All inflow stop valves in both systems are partially frozen in the OPEN position. Diverter valve 2-147-5 is extremely hard to operate.
Soil and waste diverter valves 2-145-4, 2-148-2, 2-146-3 are inaccessible because lockers are placed in front of them. Valve 2-147-3 is inaccessible because it is placed in a pipe run maze. Valve 3-56-1 (shore/overboard diverter) and valves 3-55-1 and 3-52-1 are in a locked space.

ELECTRICAL

The sump pump in the forward pump room was inoperative and was removed by ship's force for repairs.
Both control panels operate as designed.

LEVEL SENSORS

The modifications had not been accomplished on the diaphragm level sensors. The 10% sensors on both tanks were inoperative.

(1) Mud and sludge buildup on the face of the forward sensor caused the sensor to remain in the CLOSED position.

(2) The after 10% level sensor switch was faulty. Both level sensors were removed and the modifications were made to them.

Forward. The 30% and 60% level sensors were inspected and repaired by changing the disphragms and installing the new retainer rings. The switches were good and were not changed. No repairs were required on the 85% sensor.

Aft. The 30%, 60%, and 85% sensors required no repairs and are operating as designed.

After the repairs to the level sensors were completed, the tanks were filled with saltwater and all the level sensors operated as designed.

SHIP: USS BLANDY (DD-943)

SYSTEM REPAIRS

PUMPS

No discrepencies noted.

ALARMS

The alarms were tested and they operated as designed. The alarms shut off as the 85% level sensor opened when the fluid level droped in the tank. The bull's-eye alarm indicators have to be reset manually.

SYSTEM DOCUMENTATION

SDOSS is onboard and implemented.

SHIP: USS BLANDY (DD-943)

OPERATING SUMMARY

The BLANDY's CHT system operates normally in the automatic mode for transfer to shore sewers. There are several operating characteristics about this system which should be noted.

The laundry drain lines are not piped into the CHT system and are constantly draining over the side.

Both holding tanks in the system are the same size. The forward tank pumps approximately three times as much sewage as the after tank because the galley drains which include the garbage grinder eductors and dishwasher eductors, are directed to the forward CHT tank.

A number of bulkhead isolation valves are missing from the waste drain lines to the CHT tank making it impossible to isolate damaged sections of the waste drain lines.

The high-level alarms sound in the pump room and DC Central, which is not manned in port, but not on the Quarterdeck. The audible alarm stops ringing when the fluid level drops below the 85% level of the tank and the level sensor circuit opens. The alarm "bull's-eye" has to be reset manually.

The four diverter valves to the after CHT system(two soil and two waste) are inaccessible for easy use. The two soil valves are located in a nest of other piping and there is no room for a full swing of the diverter handle to change the valve position. The two waste diverter valves are inaccessible because they are placed behind permanently installed lockers in the CPO berthing compartment.

The after pump discharge valve is upside down. In this position the valve handle must be put on the bottom of the valve with the operator standing under the valve. Should the valve handle slip off the valve stem, the operator will most probably be injured.

The forward pump discharge valve is in a locked supply storeroom and is inaccessible.

The pump overboard diverter valves are in the pump discharge line such that if the diverter valve is in the overboard position, a ship outboard will not be able to pump to shore.

The ship is using constant flush on the urinals to keep these drain lines clean. The flushing rate of the urinals is set fairly high and contributes significantly to the volume of waste water collected.

SHIP: USS BLANDY (DD-943)

FROM: 10 June 78

WASTEWATER GENERATION DATA

TO: 21 June 78

SHIP STATUS In Port - 250-275 men

TEST METHOD Wastewater volume was calculated by tank volume measurements and pump event counters installed to count the number of firings of the discharge pumps.

VOLUME REDUCTION ADJUSTMENT

Both soil and waste drains were diverted to the CHT tank to establish a normal system baseline.

DATA

DATE	FWD gal	AFT gal	TOTAL gal	
10 June	18165	11250	29415	
17 June	13510	16875	30385	*
18 June	13896	13500	27396	*
21 June	13510	8602	22112	
AVERAGE			27327	

*weekend

gpcd - 99-109

Table 1

SHIP: USS BLANDY (DD-943)

FROM: 26 June 78

WASTEWATER GENERATION DATA

TO: 28 June 78

SHIP STATUS At Sea - 300 men

TEST METHOD Wastewater volume was calculated by tank volume measurements and pump event counters on each pump.

VOLUME REDUCTION ADJUSTMENT

Both soil and waste drains were diverted to the CHT tanks. In addition, the galley deep sink eductor was left on

DATA

DATE	FWD gal	AFT gal	TOTAL gal
26 June	39372	13464	52836
27 June	43232	13090	56322
28 June	43232	11220	54452
AVERAGE			54537
			gpcd - 182

Table 2

SHIP: USS BLANDY (DD-943)

FROM: 29 Ju

WASTEWATER GENERATION DATA

TO: 4 Ju

SHIP STATUS In port 250-275 men

TEST METHOD Wastewater volume was calculated by tank volume measurements and pump event counters attached to the discharge pumps.

VOLUME REDUCTION ADJUSTMENT The CHT system was diverted to the transit mode and the saltwater eductor in the galley deep sink was secured. Only black water was collected.

DATA

DATE	FWD gal	AFT gal	TOTAL gal
29 June	14282	10472	24754
30 June	14282	10472	24754
1 July	16212	9350	25562
2 July	10422	9724	20146
4 July	17756	3366	21122
AVERAGE			23268

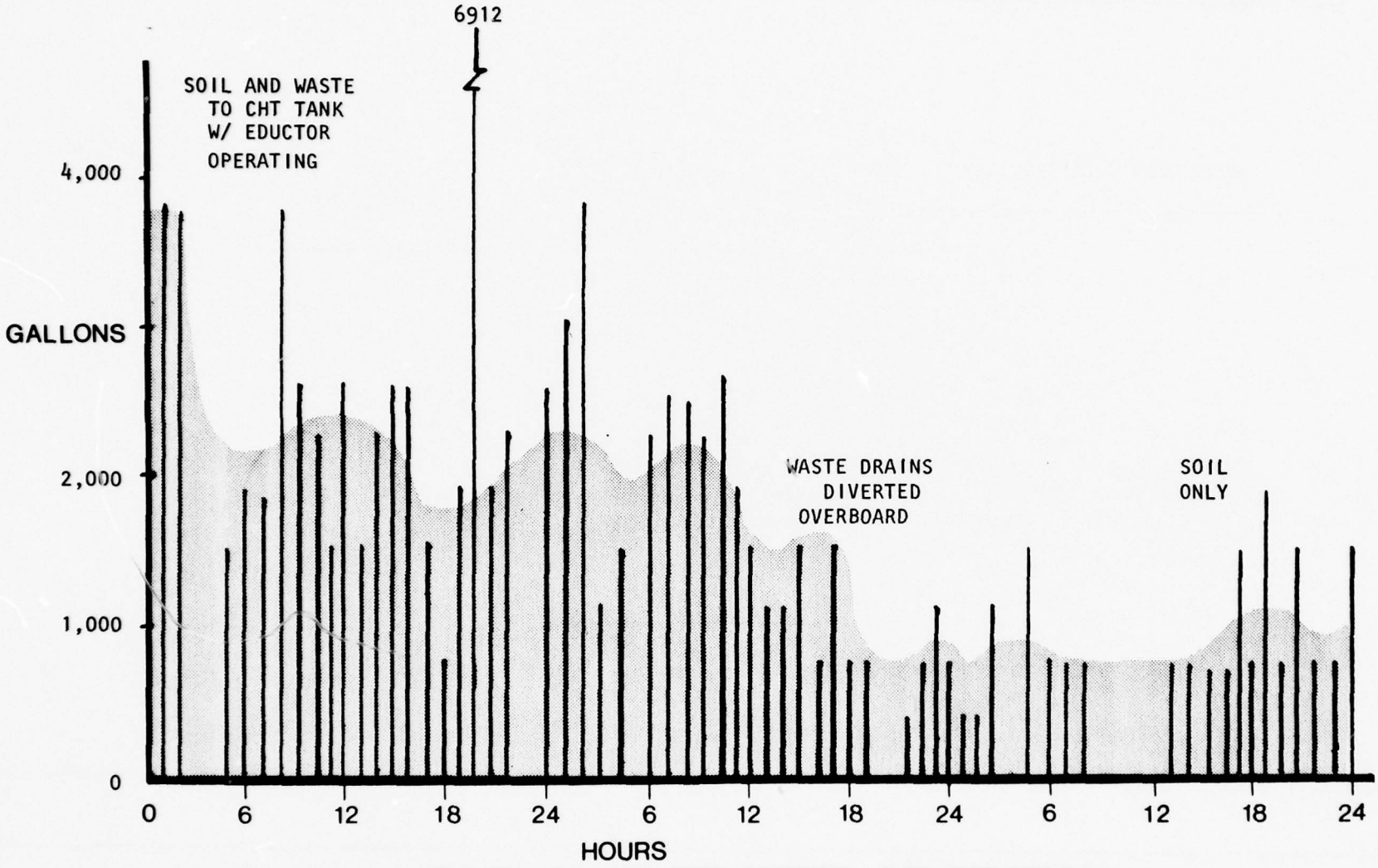
gpcd - 85-93

Table 3

SHIP: USS BLANDY (DD-943)

FROM: 28 Jun 78

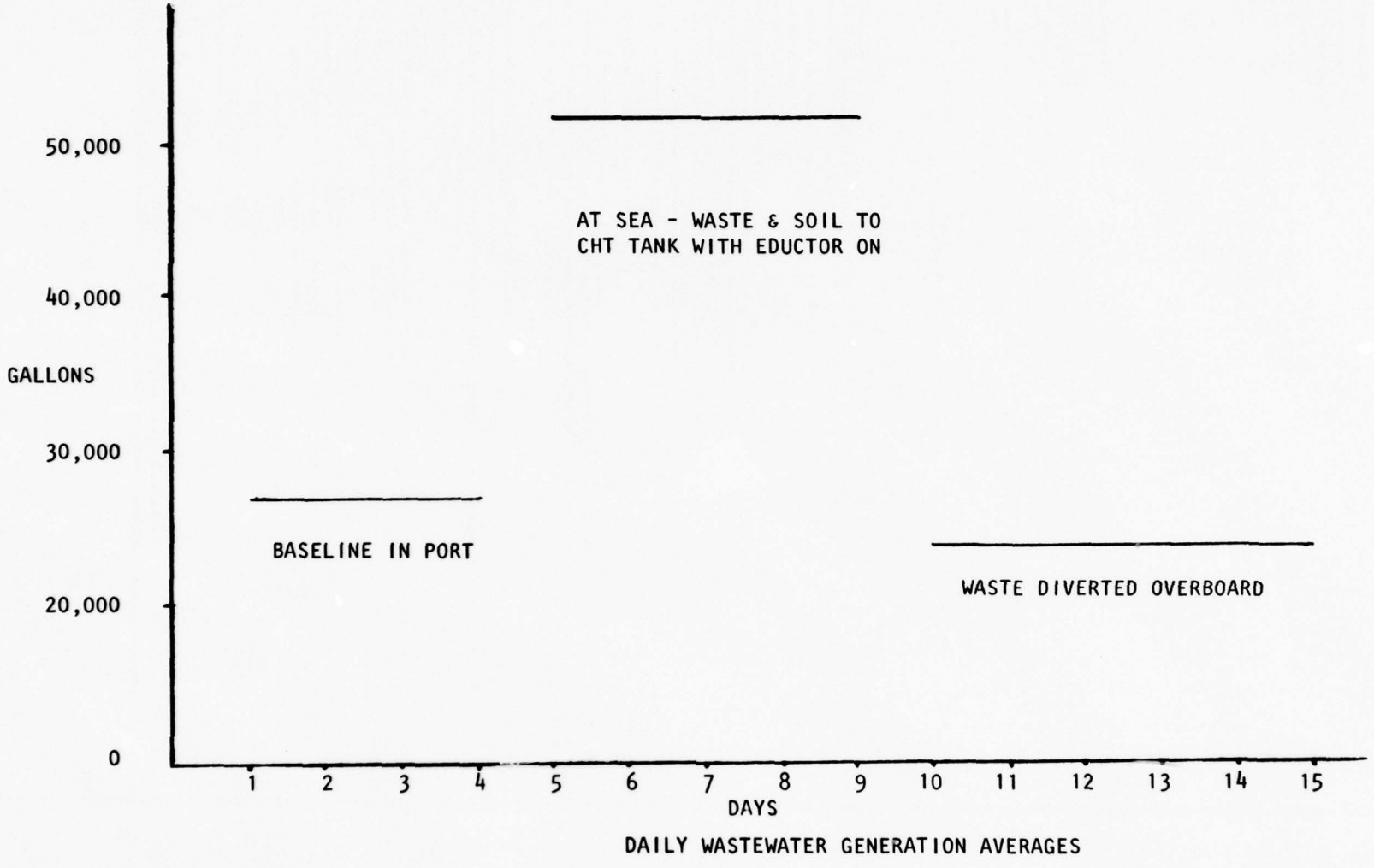
TO: 30 Jun 78



DIURNAL WASTEWATER GENERATION

FIGURE 1

SHIP: USS BLANDY (DD-943)



DAILY WASTEWATER GENERATION AVERAGES

FIGURE: 2

SHIP: USS BLANDY (DD-943)

CONCLUSIONS

The data was gathered with the CHT system operating in several conditions. The base line information was collected with the system collecting all the drains. The at-sea period had all the drains diverted to the tank plus the addition of a constant flow eductor diverted to the tank. The final inport data was collected with all the drains, except the soil drains, diverted over the side and the eductor secured.

A baseline average of 27,327 gallons per day was obtained. This averages to 104 gallons per man per day. The four days of data are shown in Table 1.

A galley drain eductor constantly flowing to the CHT tank increases the average gallons per day rate to 54,537 gallons per day or 182 gallons per man per day. This shows that a high volume source of water like an eductor which is not secured after use can be the major contributor to ship's wastewater. Three days of data are shown in Table 2.

The data collected in Table 3 illustrates the effect of diverting the waste drains over the side and securing the saltwater eductor. The average generation rate drops to 23,268 gallons per day or 89 gallons per man per day.

The less-than-expected drop of the average rate generated per day is due to the constant flushing of the urinals. The constant flushing used was much greater than the trickle flushing noted on other vessels. The rate of constant urinal flushing must be regulated so that the collected volumes of wastewater is not excessive.

Figure 1 shows the total gallons pumped per hour during the different modes of operation. An average of 2200 gallons per hour was generated with all drains and an eductor going into the tank (26 June being a typical day). With only the soil drains being collected, an average of 969 gallons per hour was generated. This again illustrates the need to know what drains have been diverted to the tanks during the different modes of operation.

Based on the sewage generation data gathered in Table 3, the forward tank produces 607.9 gallons per hour and the aft tank produces an average of 361.5 gallons per hour. At these rates, the transit holding times until 85% are reached are:

Forward------1.4 hours
Aft----------2.4 hours

The CHT pump rooms produce the following volumes for each duty pump cycle:

DUTY VOLUME

Forward tank----------387 gallons
Aft tank----------374 gallons

SHIP: USS BLANDY (DD-943)

RECOMMENDATIONS

The daily generation rate of sewage by the BLANDY as collected by the CHT system shows that the BLANDY is in excess of the 60 gallons per man per day design standard. This high rate is the result of the high volumes of flushing water used to maintain a constant flush of the urinal drains. Choaking this flushing to a trickle would greatly reduce the volume received by the CHT tank and keep the drain lines clear.

Salt water eductors that are left constantly on also greatly increase the volumes generated. Care should be taken to identify these sources and they should be labeled to be secured when not in use.

The system needs regular operation to remain in good working order. It is recommended that even while the ship is at sea, the system be operated to collect and discharge sewage. Experience has shown that after a time of inactivity, the system is difficult to reactivate.

The following system modifications should be considered to enhance the CHT operation and maintenance.

1. The after pump discharge diverter valve, 2-147-5, should be rotated 180^{o} to put the valve stem on top of the valve body to prevent possible injury to the operator.

2. Valves 2-145-4, 2-148-2, 2-146-3 and 2-147-3 should be made accessible to the operator.

3. Valve 3-56-1 (the forward pump discharge diverter) does not have any remote operating devices and this valve is presently located in a locked storeroom. An effective remote operating device is required.

4. A remote high level alarm should be installed on the Quarterdeck.

5. Since there are two sources of power into the pump control panel (main power and alarm circuits), a warning sign should be attached to the controller.

6. A light should be installed on the control panel to give the OFF/ON status of the motor controller.

SHIP: USS VULCAN (AR-5)

PORT: Norfolk

DATE: 22 Jun **TO** 7 Jul 78

SHIP CLASS VULCAN class AR

CHT SYSTEM

Comminutor type, 2 independent systems, fore and aft tanks
4 receiving deck risers and 2 discharge deck risers aft
Peabody-Barnes pumps, 100 gpm, at 90 feet head
Mercury float sensors
14 airconditioners tied into CHT drains
Urinals continuously flushed

CERTIFICATION

Provisionally certified by COMNAVSURFLANT letter
29 June 1978

OPERATING STATUS

Holding and discharge pumps operating as of
22 June 1978

INSTALLATION **DATE** February 1976
YARD Metro Machine Inc.

CREW SIZE **AT SEA** 767
IN PORT 767

SHIP: USS VULCAN (AR-5)

TEST PREPARATION

The USS VULCAN was boarded on 19 June, 1978 to activate the installed CHT system and gather data on the sewage generation rates for the system. The CHT system was installed in 1976 and had not been used, except for the gravity drains, since installation. Activation of the system required repairing some deficiencies and instructing the crew on the proper operation of the system. All valves and pumps were found in good working order indicating a well-run PMS program.

Several briefings were held with the engineering division officers, the repair division and the Commanding Officer on the operation of the CHT system and personnel safety. After initial briefings the system piping was traced with the system's assigned personnel, to locate all diverter valves and mark piping for content and flow direction.

With all waste and soil drains over the side, the aft system was activated using a continuous flushing from the salt water spray. The system was allowed to continually flush for 24 hours to check the reliability of pump room equipment and piping. After flushing, the CHT tank was inspected from the 10-inch access port. The 15-foot long tank contained a surge bulkhead disc fuser, two spray nozzles, mercury level sensors, and 90^{o} elbow pump sections. The coating of the tank was in good condition with some rust on the overhead.

The waste drains were diverted to the CHT tank to be pumped over the side. Drains began to back up in the crew's head portside aft. A blank was removed from the waste line overboard/CHT diverter valve (4-109-2). The soil drains were then diverted to the CHT tank without backing up.

In the forward CHT pump room the controller was not shutting down the pumps at the 10% tank level. Inspection of the CHT tank showed that the 10% mercury level sensor was placed too low in the tank so that pumps would lose suction before shutting off by the sensor. The level sensors were rewired using the 30% level sensor as a low level sensor. The details of the sensor problem and rewiring are discussed in the System Repairs section and the Appendix of this report.

TEST PREPARATION

The inspection of the tank also revealed a similar tank interior layout as the aft tank except:

1. The 18 foot tank had no surge bulkhead.

2. The pump suctions ended in straight pipes and did not turn down.

3. The tank coating had deteriorated showing considerable rust under stringers and frames. Portions of mortar used to smooth tank walls had cracked and flaked away.

After pump room repairs were completed, the system was tested with salt water continuous flushing. Waste drains were diverted to the forward tank. A blockage occurred in the line similar to aft drain line and a blank was found and removed in diverter valve 4-27-3. Soil lines were then diverted without incident.

A sewage hose handling party was instructed and a hose rigged to pump to the pier. Both the forward and aft pump rooms discharge to shore through a common deck riser and single hose to the pier.

Electric event counters were installed on the motor controllers in each pump room. Sewage volumes were from direct tank measurements and the pump event counters on the duty pump controller. After a base generation rate was established with gray and black water to the CHT tanks, the gray water was diverted over the side to obtain a base black water generation rate.

While tracing plumbing drains it was discovered that some 14 air conditioner salt water cooling lines discharged into CHT soil or waste drains. This configuration greatly increases wastewater production by the ship.

SHIP: USS VULCAN (AR-5)

SYSTEM REPAIRS

VALVES & PIPING

Pipe runs were incorrectly marked for flow direction and content. Proper markings were made as the lines were traced.

All diverter valves are in locked store rooms without reach rods. Blanks were found and removed in an aft and a forward waste drain diverter valves (4-109-2 and 4-27-3).

ELECTRICAL

The forward pump room 110 volt outlet and lighting switches are located in a locked store room. The outlet line was traced and a fuse replaced.
The forward comminutor indicator light was missing.

LEVEL SENSORS

The forward CHT pump room 10% level sensor was mounted too low in the tank to shut off the pumps. The sensor was found to be mounted directly above a disc fuser which would not allow the sensor to fall. The 10%, 30% and the 60% level sensors were rewired to the next higher sensor. With this modification the duty pump was turned on at the 60% level and secured by the low level sensor at the 30% level. The 85% level sensor was wired to serve as both high water alarm and standby pump activator. The 10% level sensor was not used.

PUMPS

The after receiving comminutor used for receiving nested ship's sewage was found jammed. The blade mechanism was found to be heavily rusted. The vanes were cleaned and the comminutor repaired.

ALARMS

The alarms were tested and operated as installed. The alarms reset automatically in the pumproom. Alarms sound in the pump room, Engineer Log Office, and in Main Control.

SYSTEM DOCUMENTATION

SDOSS for the system is not yet available.
Health and pressure warning placards were installed at each deck riser.

SHIP: USS VULCAN (AR-5)

OPERATING SUMMARY

The VULCAN's CHT system operates normally in the automatic mode for transfer to shore sewers. The system has several operating pecularities that are a result of placement of certain valves, inaccessibility of the two pumprooms, and the common discharge riser aft. In addition, several ship's air conditioners drain cooling salt water into the forward CHT drain lines. This results in abnormally high wastewater production for this class of ship. The wastewater load is unevenly distributed between the forward and aft CHT tanks. The laundry drains, galley drains and air conditioners all drain into the forward tank.

All overboard/CHT tank diverter valves for the plumbing drains are in locked store rooms. Keys to these spaces must be available to the duty HT. To reach the pump rooms the HT must climb down an access trunk four or five decks to the forward or aft pump rooms.

Often the duty/standby pump cycle is disrupted by the bouncing of the standby level sensor which causes both pumps to pump. This is particularly common in the long 18 foot forward tank which has no baffle bulkhead.

In the forward pumproom the level sensors have been rewired as described in the appendix of this report. Because of the new higher placement of the low level sensor, a greater volume of sewage will remain in the tank between pumpings. This will allow better aeration of the tank and should keep the tank cleaner. Since the standby pump is activated by the 85% sensor, which is also the high level alarm, the alarm will ring as the standby pump fires.

Both air compressors in the pump rooms are operable. However, ship service air is able to provide adequate tank aeration.

Deck risers are installed to receive sewage from nested ships at stations forward and aft. By allowing the outboard ships to hook up to the aft discharge risers these ships can discharge to shore without first pumping into the VULCAN's holding tanks which are heavily taxed by normal ship loads.

The urinals on the forward CHT drain system are set for a constant salt water flush. The after urinals are not being constantly flushed.

SHIP: USS VULCAN (AR-5)

FROM: 25 June 78

WASTEWATER GENERATION DATA

TO: 28 June 78

SHIP STATUS In Port - 767 men

TEST METHOD Wastewater volume was calculated by tank volume measurements and a pump event counter wired to count the duty pump firings.

VOLUME REDUCTION ADJUSTMENT

Both soil and waste drains were diverted to the CHT tank to establish a normal system baseline.

DATA

DATE	FWD gal	AFT gal	TOTAL gal	
25 June	187590	37200	224790	*
26 June	197210	45570	242780	
27 June	161135	48360	209495	
28 June	139490	65100	204590	
AVERAGE			220414	
			gpcd - 287	

* weekend

Table 1

SHIP: USS VULCAN (AR-5)

WASTEWATER GENERATION DATA

FROM: 29 June 78
TO: 6 July 78

SHIP STATUS In Port - 767 men

TEST METHOD Wastewater volume was calculated by tank volume measurements and a pump event counter wired to count the duty pump firings.

VOLUME REDUCTION ADJUSTMENT

Soil drains were diverted to the CHT tank and waste drains were diverted overboard. This would establish a baseline for holding black water only.

DATA

DATE	FWD gal	AFT gal	TOTAL gal	
29 June	134680	29760	164440	
30 June	139490	31620	171110	
1 July	118446	27900	146346	*
2 July	79365	20460	99825	*
3 July	86580	21390	107970	
4 July	72150	19530	91680	**
5 July	65104	53940	119044	
6 July	139490	39990	179480	
AVERAGE			134987	

gpcd - 176

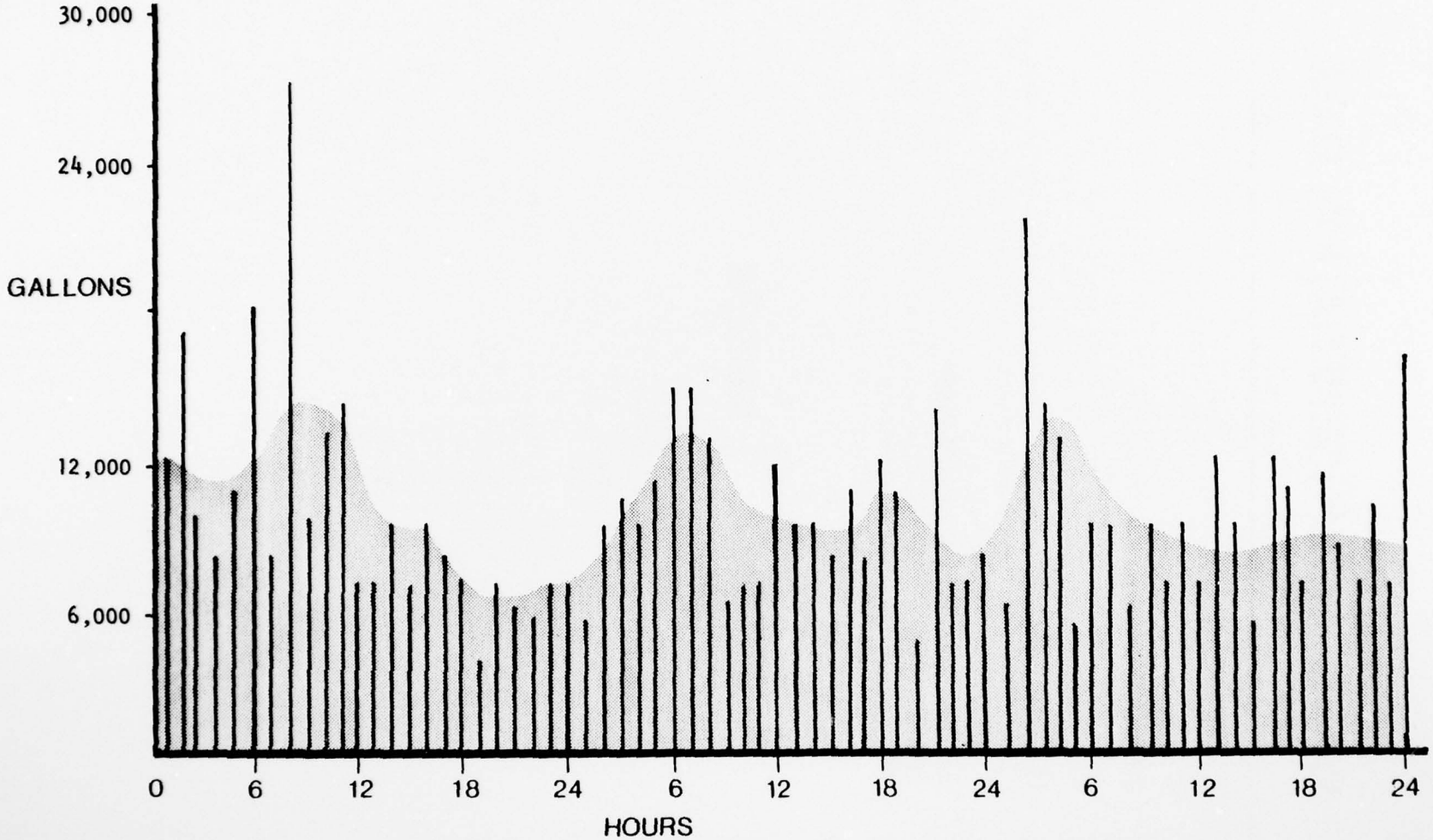
* weekend
** holiday

Table 2

SHIP : USS VULCAN (AR-5)

FROM : 26 June 78

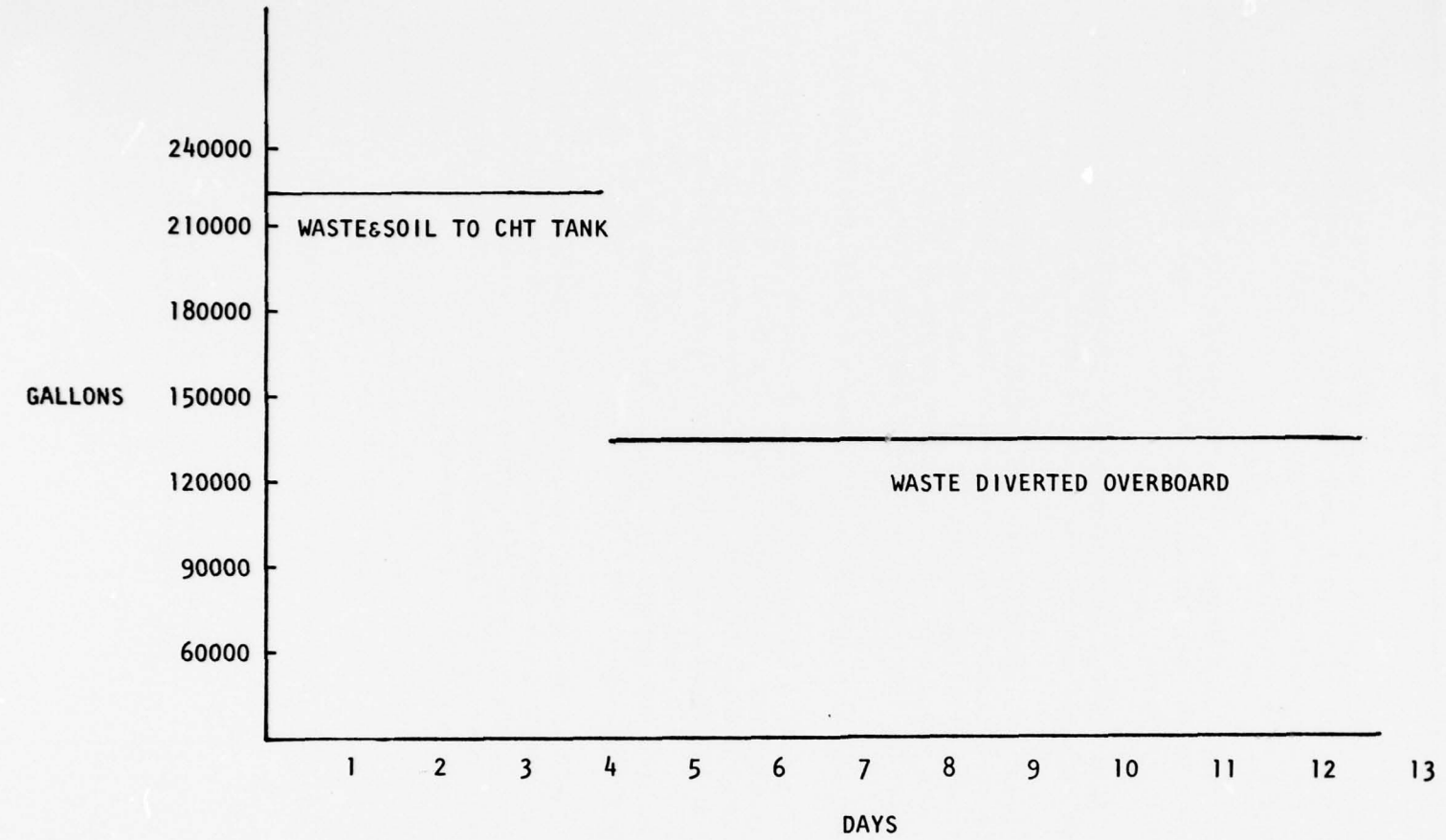
TO : 28 June 78



DIURNAL WASTEWATER GENERATION

FIGURE : 1

SHIP: USS VULCAN (AR-5)



DAILY WASTEWATER GENERATION AVERAGES

FIGURE: 2

SHIP: USS VULCAN (AR-5)

CONCLUSIONS

Wastewater generation data from the VULCAN was gathered from the two CHT pump rooms first with soil and waste drains diverted to the tanks and then with the waste drains diverted overboard. All data were collected while the ship was in port.

A baseline average of 220,000 gallons per day was recorded. This averages to 287 gallons per man per day. Four days of baseline data are shown in Table 1.

Table 2 shows an average of 135,000 gallons of wastewater per day or 175 gallons per man per day with the waste drains diverted overboard.

These high volumes are the result of saltwater cooling drains from 14 air conditioners that are plumbed into the CHT drains and cannot be separately diverted overboard. The data show that these drains are plumbed into both waste and soil drains and cannot be diverted from the tank entirely by diverting waste drains over the side.

In addition, the forward system's urinals are constantly flushed.

Figure 1 presents three days of hourly wastewater generation with all drains diverted to the CHT tanks. The graph shows a minimum average flow rate of 9,000 gallons per hour with peak averages of about 14,000 gallons per hour. Single hourly peaks have been recorded as high as 28,000 gallons per hour. Estimates for the salt water load from the 14 air conditioners are about 8,400 gallons per hour. This figure is close to the minimum average flowrate.

Based on the sewage generation data gathered in Table 2, the forward tank produces, with waste drains diverted overboard, a maximum of 5,800 gallons per hour. The aft tank produces, with waste drains diverted overboard, a maximum of 2,208 gallons. At these rates, transit holding times until 85% tank level is reached are:

Forward---------- 1.2 hours
Aft---------- 2.7 hours

The CHT tanks collect the following volumes for each duty pump cycle:

DUTY VOLUME

Forward tank---------2400 gallons
Aft tank---------- 930 gallons

SHIP: USS VULCAN (AR-5)

RECOMMENDATIONS

The daily generation rate of wastewater by the VULCAN far exceeds what might be considered normal for a ship with her complement of men. This problem is a direct result of the lack of separate overboard drains for some of her air conditioners. If the high level alarms sound, there is little time until the tank is completely full. These high flow rates are particularly evident in the forward CHT pump room. It is recommended that separate drains be provided for those air conditioners that are plumbed into the CHT drains. In the interim, if wastewater production of the VULCAN is causing an excessive load on the ship's transfer system or the pier sewer system, waste drains can be diverted overboard to reduce the load by about 35%.

It is recommended that the CHT system holding tanks and pumps be operated continually and not secured while at sea. Experience has shown that after a time of inactivity the system deteriorates requiring additional maintenance.

Since the drain line diverter valves are in locked store rooms, a set of keys should be available at all times to the duty HT.

It is recommended that the ship's service air be used for tank aeration instead of the pump room air compressor. There is sufficient air available from the ship service system which precludes the nesessity of using the noisy installed compressor.

For ships nested outboard of the VULCAN it is suggested that they use the aft discharge risers and pump through the VULCAN rather than pumping into the VULCAN's CHT tanks through the receiving deck risers. This will reduce the loading on the VULCAN's tanks.

The following modifications should be considered to enhance the CHT system's operation and maintenance:

1. A remote high level alarm should be installed on the Quarterdeck.

2. Since there are two power sources in the pump control panel (main power and alarm circuits), a warning sign should be attached to the control panel.

3. An indicator light should be installed on the control panel door to indicate if the control relays have been activated.

SHIP: USS VULCAN (AR-5)

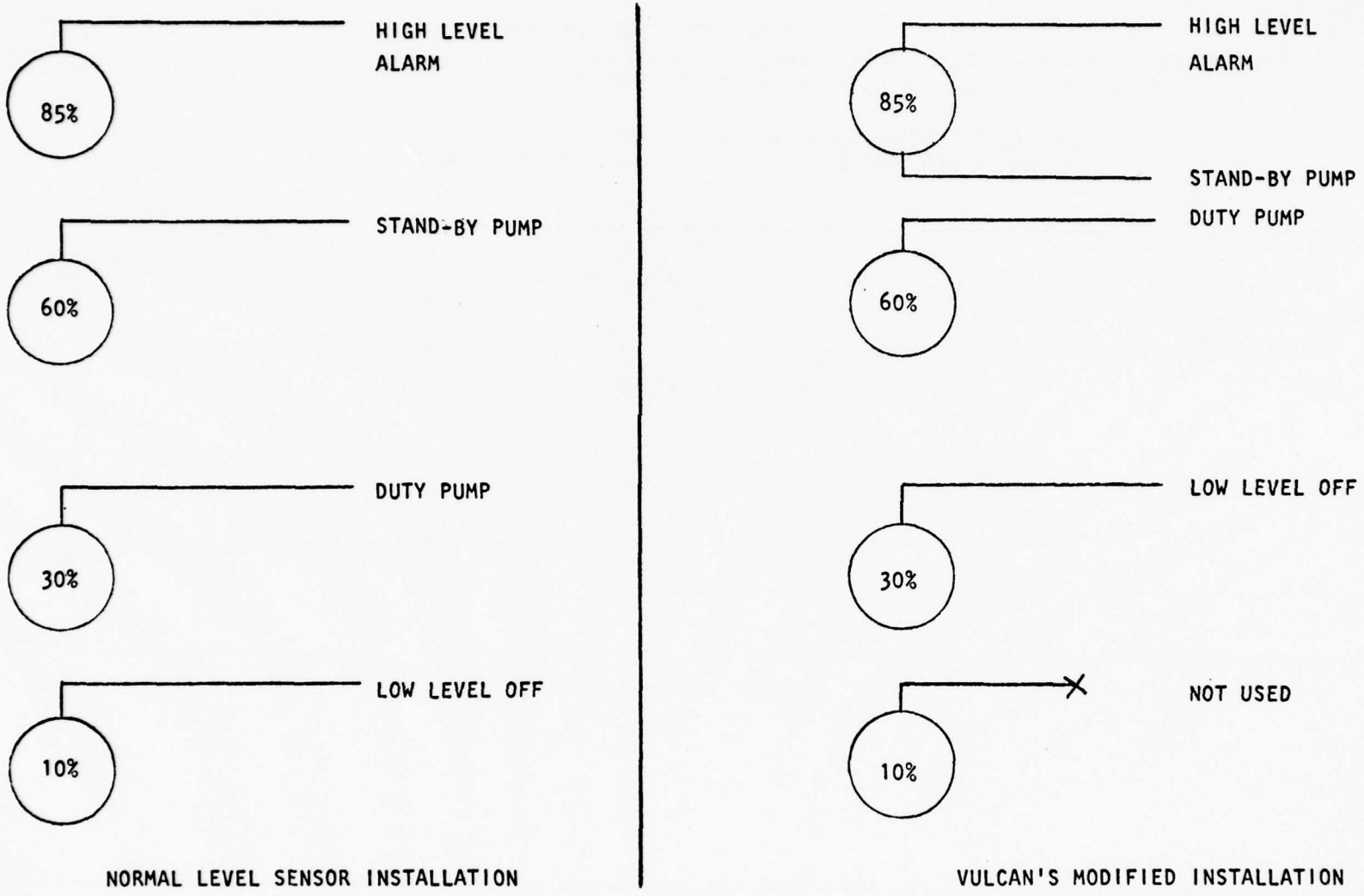
RECOMMENDATIONS

4. There is no eductor in the aft CHT pump room. A firemain eductor should be installed. Presently the sump is pumped out by a bilge stripping line. This is a difficult operation.

5. It is recommended that the wiring modification of the forward CHT tank level sensors not be changed because the larger low level volume has better aeration. Similar rewiring of the aft system should be considered.

APPENDIX

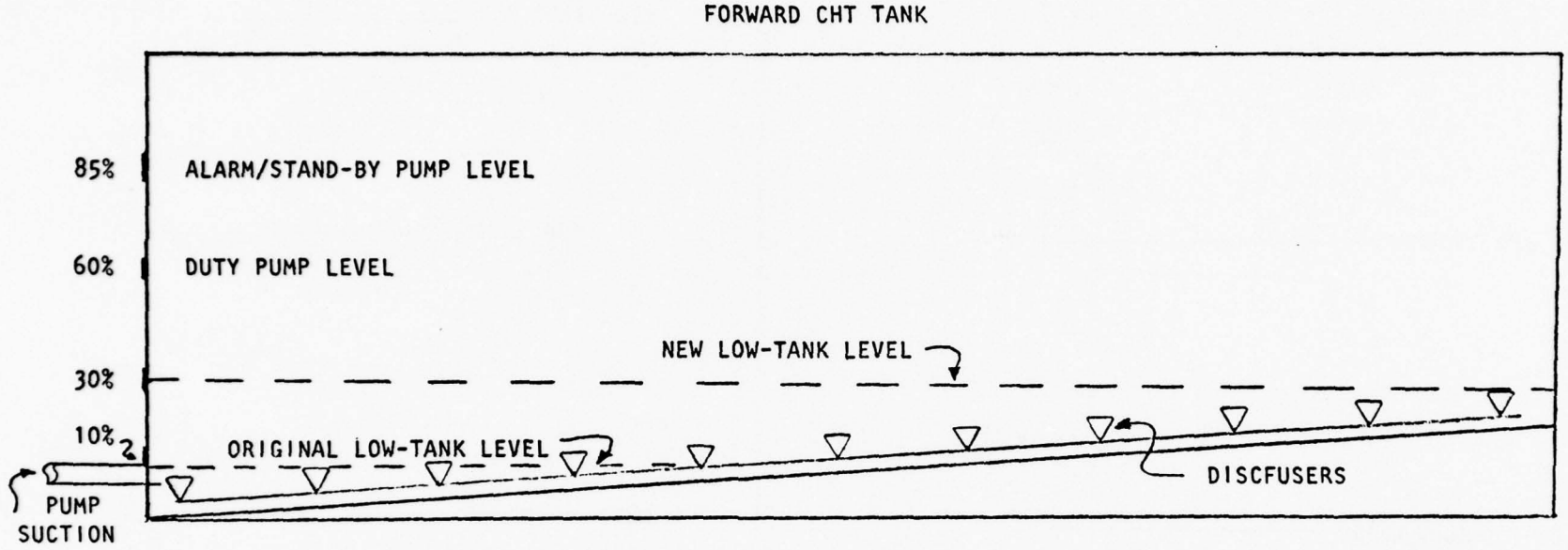
SHIP: USS VULCAN (AR-5)



LEVEL SENSOR MODIFICATIONS TO VULCAN FWD. TANK

FIGURE: A-1

SHIP: USS VULCAN (AR-5)



NOTE: THE ORIGINAL INSTALLATION CAUSED THE PUMPS TO LOSE SUCTION BEFORE THE 10% LEVEL SENSOR WOULD OPEN.

THE NEW LOW-TANK LEVEL ALLOWS ALL THE DISCFUSERS TO BE SUBMERGED AT ALL TIMES. THIS SHOULD IMPROVE AERATION AND PREVENT SLUDGE BUILD-UP.

THE MERCURY LEVEL SENSORS CONTAIN TWO SETS OF SWITCH WIRES. THE STAND-BY CONTROL WIRE WAS WIRED TO THE SPARE SET.

VULCAN CHT TANK CROSS SECTION, FWD. PUMP ROOM

FIGURE: A-2

SHIP: USS FAIRFAX COUNTY (LST-1193)

PORT: Norfolk

DATE: 10 Jul **TO** 24 Jul 78

SHIP CLASS

NEWPORT class LST

CHT SYSTEM

Comminutor type
2 independent systems with 2 discharge deck risers amidships (port and stbd) for the forward system and 1 discharge riser aft (stbd quarter) for the aft system.
Peabody-Barnes pumps rated @ 100 gpm at 70 feet head.
Mercury float level sensors

CERTIFICATION

Pending ship confirmation.

OPERATING STATUS

Holding tanks and pumps operating as of 12 July 78

INSTALLATION

DATE February, 1978

YARD Norfolk Shipyard

CREW SIZE

AT SEA 248/404(w/troops)

IN PORT 200

TANK SIZE

FWD: 30%-1100 gal, 85%-3145 gal., Full-3700 gal.
AFT: 30%-706, 85% 1955 gal., Full-2300 gal.
Pump volumes

SHIP: USS FAIRFAX COUNTY (LST-1193)

TEST PREPARATION

The USS FAIRFAX COUNTY (LST-1193) was boarded on 10 July 1978 to activate the installed CHT system and to gather data on the sewage generation rates for the system. The system is relatively new, having been installed in February of 1978. The system had not been used, but due to valve misalignments, a full tank of septic sewage was found in the after tank.

The pumps, controllers, level sensors, valves, and associated equipment were inspected for proper operation. No system repairs were required in activating this system.

The tanks were opened and inspected to determine the state of preservation and the "swing" of the mercury level sensors. After closing and sealing the tanks, the saltwater flushing was activated and each tank was allowed to fill and pump down continiously for 24 hours to determine the reliability of the control and pumping circuits. At the conclusion of the 24 hour period, soil and wasted waters were diverted to the holding tanks. A back-up of the port side aft wastewater drains to the after tank was encountered. Upon tracing the wastewater line, a bulkhead isolation valve downstream from the diverter valve was found to be shut. The valve was opened and the line then drained normally.

A system briefing and a hose handling instruction period was held with ship's force personnel. Those personnel concerned with the hose handling evolution were instructed in the proper methods of hook-up, flushing, and disconnection of the sewage hose.

To collect sewage generation data, electric event counters were installed in the control panel.

SHIP: USS FAIRFAX COUNTY (LST-1193)

SYSTEM REPAIRS

VALVES & PIPING

None

ELECTRICAL

None

LEVEL SENSORS

None

PUMPS

None

ALARMS

None

SYSTEM DOCUMENTATION

SDOSS, data plates are on board. PMS not on board but was requested.

SHIP: USS FAIRFAX COUNTY (LST-1193)

OPERATING SUMMARY

The FAIRFAX COUNTY's CHT system operates normally in the automatic mode to transfer to the shore sewers. The diverter valves and bulkhead stops are easily accessible and operate freely. Remote operating gear, where required, also operates freely.

The alarm circuit was tested and operated satisfactorily. The alarms sound in the pump room, Main Control, and on the Quarterdeck. There is no remote alarm provided in D.C. Central. The audible alarms deactivate when the fluid level in the tank drops below the 85% level, but the alarm "bull's eye" in Main Control requires manual resetting.

The laundry is piped to the forward tank, as well as the galley and scullery drains. This tank is the larger of the two, and has no problem in accepting the inflow. The urinals are not constant flush but are controlled by flushometers.

The brig head is below the level of the aft pumproom overflow piping which causes a sewage backup when the after tank overflows. The drains from this space MUST be diverted as soon as the high level alarm sounds to prevent backup.

A pump through capability is possible only at the forward CHT stations. Aft, there is a common manifold on the starboard quarter with two camlock fittings. If a ship is moored outboard and wishes to pump ashore, hoses must be run across the FAIRFAX COUNTY's stern.

SHIP: USS FAIRFAX COUNTY (LST-1193)

WASTEWATER GENERATION DATA

FROM: 15 Jul 78

TO: 19 Jul 78

SHIP STATUS In port - 200-248 men

TEST METHOD Wastewater volume was calculated by tank volume measurements and pump event counters installed to count the number of firings of the discharge pumps

VOLUME REDUCTION ADJUSTMENT

Both soil and waste drains are diverted to the CHT tank to establish a normal system base line.

DATA

DATE	FWD gal	AFT gal	TOTAL gal	
15 July	6600	3700	10300	*
16 July	44000	5180	49280	**
17 July	35200	5920	41120	**
18 July	12100	5180	17280	*
19 July	7700	2960	10660	*
AVERAGE			25728	

* Baseline

** Constant Flush on Forward Tank

gpcd - 104-129

Table 1

SHIP: USS FAIRFAX COUNTY (LST-1193)

FROM: 20 Jul 78

WASTEWATER GENERATION DATA

TO: 24 Jul 78

SHIP STATUS Inport - 200-248 men

TEST METHOD Wastewater volume was calculated by tank volume measurements and pump event counters on each pump

VOLUME REDUCTION ADJUSTMENT

The CHT system was diverted to the transit mode and all saltwater flushing and eductors secured. Only black water was collected

DATA

DATE	FWD gal	AFT gal	TOTAL gal
20 July	1100	1480	2580
21 July	1100	2960	4060
22 July	1100	2960	4060
23 July	0	4440	4440
24 July	1100	2220	3320
AVERAGE			3692

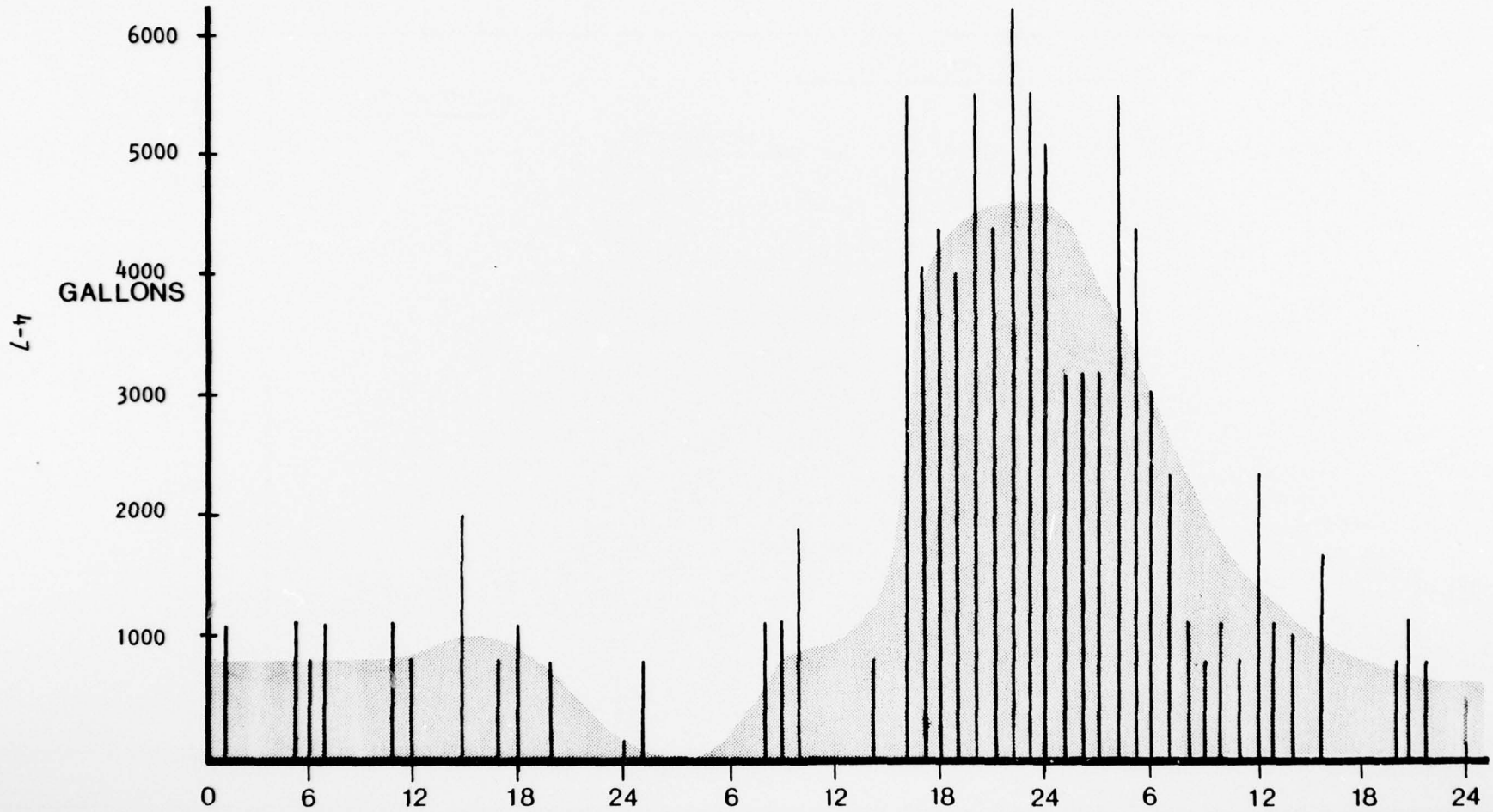
gpcd - 15-18

Table 2

SHIP: USS FAIRFAX COUNTY (LST-1193)

FROM: 15 Jul 78

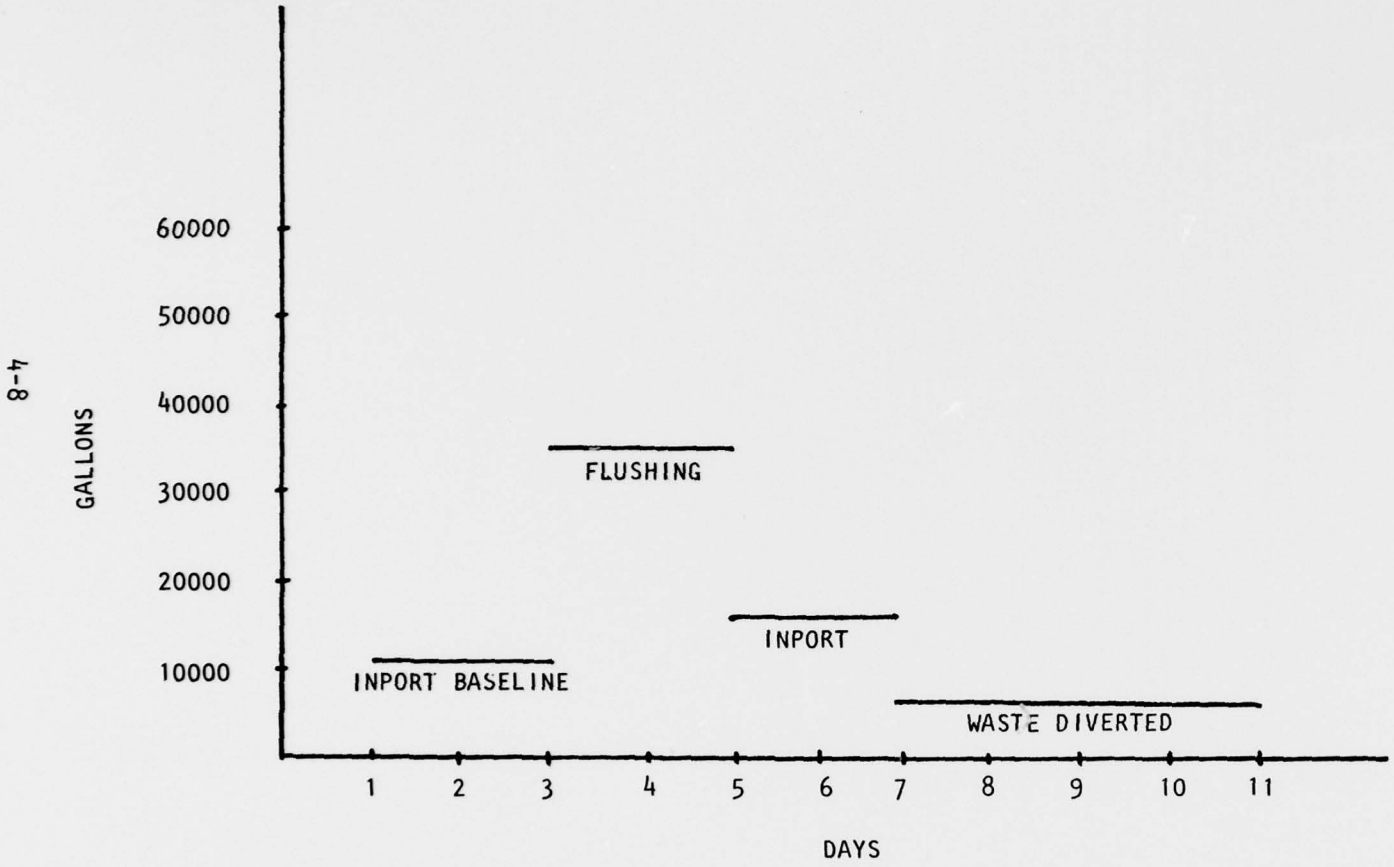
TO: 18 Jul 78



DIURNAL WASTEWATER GENERATION

FIGURE 1

SHIP: USS FAIRFAX COUNTY (LST-1193)



DAILY WASTEWATER GENERATION AVERAGES

FIGURE: 2

SHIP: USS FAIRFAX COUNTY (LST-1193)

CONCLUSIONS

Wastewater generation data from the FAIRFAX COUNTY was gathered from two CHT pump rooms, first with soil and waste drains diverted to the tanks, and then with the soil only drains to the tank. All data was collected with the ship in port. No troops were embarked. No urnials were on constant flush.

A baseline average of 12,747 gallons per day was recorded. This averages to 51 gallons per man per day. Table 1 shows three days of baseline data.

Table 1 also shows the effect of inadvertingly leaving the tank flushing on, increasing the generation rate forward by 354 percent.

Table 2 shows an average of 3,692 gallons of soil water per day with the waste drains over the side. This averages to 18 gallons per man per day.

After diverting gray water over the side, the wastewater generation rated dropped drastically in the forward system, while in the aft system, the generation rate remained approximately the same amount, indicating that grey water generation rates are more of a concern in the forward system than in the aft system. The laundry has been identified as a high grey water producer for the forward system.

Figure 1 presents three consecutive days of hourly wastewater generation with all drains diverted to the CHT tanks. The graph shows a minimum flow rate of zero gallons per hour, and a maximum of 2,200 gallons per hour when not flushing. A maximum of 6,240 gallons was noted when the tank was being flushed. This shows the effects of flushing on the sewage generation rate and the load that an unexpected flushing can put on the system.

Figure 2 shows the average wastewater generation over the data collection period.

Based on the sewage generation data gathered in Table 2, with gray water drains diverted over the side, the forward tank produces a maximum of 46 gallons per hour, while the aft tank produces 185 gallons per hour. At these rates, the transit holding times until the 85% tank level is reached (soil water only) are:

Forward.....68.3 hours

Aft.....10.5

SHIP: USS FAIRFAX COUNTY (LST-1193)

CONCLUSIONS

The CHT tanks collected the following volumes for each duty pump cycle:

Duty Volume
Forward Tank.....1100 gallons
Aft Tank.....750 gallons

SHIP: USS FAIRFAX COUNTY (LST-1193)

RECOMMENDATIONS

The daily generation of sewage by the FAIRFAX COUNTY, as collected by the CHT system, is not excessive for normal operations. The wastewater generated is under the 60 gallon per man per day guidelines (51.0 gallons). Though there is no constant flushing of the urinals, the laundry produces a large amount of wastewater. The effects of diverting the gray water over the side can be seen in Tables 1 and 2 as the averages drop forward when the wastewater was diverted over the side.

The CHT tank and its system should be used continiously, if possible, at sea as well as in port. Continuous operation will prevent a sludge buildup and prevent deterioration of an idle system. If the system is to remain idle, particular care must be taken to ensure the tank is empty of sewage, flushed properly, and pumped down as far as possible. Within the tank, a sump is provided to aid the pumps in taking a suction. If the tanks are improperly laid up, sludge collects in these sumps and will plug up the pump suctions. If this does occur, back flushing through the pump using the flushing main is the only way to clear the obstruction.

The installed air blowers should be used whenever possible. Even though ship's service air is available, it must be available for the engineering control air system. The CHT aeration system uses such large volumes of air that a constant pressure to the control air system cannot be guaranteed. It is recommended to use ship's service air for the CHT system only when absolutely necessary and not at all when the engineering control system is in use.

Presently, there are no indicators of any sort to tell the operators and roving watch standers if the system is "ON". To ensure the system is working, the operator must push the "START" button whenever he is in the space. A "POWER ON" light should be installed on the front of the power panel that will be energized whenever the control panel is energized. This will aid the observer in detecting when there has been a power loss to the system.

The flushing system valve in the forward tank was left on by crew-members accidently. If this had not been discovered through the use of event counters that indicated a sudden rise in the number of pumping firings, this problem could have continued for an unknown period of time. As seen in the collected data, the saltwater flushing can increase the waste-water generation by 3.5 times. The valves supplying the salt water should be identified as to warn the operator to secure them when they are not needed.

SHIP: USS DONALD B. BEARY (FF-1085) **PORT:** Norfolk

DATE: 18 Jul **TO** 21 Jul 78

SHIP CLASS

KNOX class Fast Frigate

CHT SYSTEM

Strainer type, 2 independent systems, fore and aft tanks with 2 deck risers each.
Peabody-Barnes pumps, 100 gpm, at 70 feet head
Mercury float level sensors

CERTIFICATION

Pending ship confirmation

OPERATING STATUS

Holding and discharge pumps operating as of 21 July 1978

INSTALLATION

DATE January 1976
YARD Bath, Maine

CREW SIZE

AT SEA 240
IN PORT 220

TANK SIZE FWD 30%-275 gal, 85%-973 gal., Full-1,145
AFT 30%-160 gal, 85%-462 gal., Full-544 gal.
Duty pump volumes:

SHIP: USS DONALD B. BEARY (FF-1085)

TEST PREPARATION

On 18 JULY, the USS DONALD B. BEARY (FF-1085) was boarded to activate the installed CHT system and to collect sewage generation data. An inspection of the pumprooms and other spaces with CHT valves and piping did not reveal any obvious problems. The controller, pumps, and valves operated as designed. The system was recently installed and as a result, was in good condition.

A problem was encountered with the low level sensor in the forward pumproom. The 10% mercury level sensor did not always secure the pumps causing them to lose suction and continue running. The tank was flushed with salt water and the interior inspected. The pigtail on the sensor was too long causing the mercury switch to hit the tank bottom and the pumps to operate errectically. The packing nut was loosened and the pigtail shortened by 2". The interior coating of the tank was excellent.

A valve in the salt water flushing line to the forward CHT tank did not seat completely allowing salt water to continually leak into the tank. The flushing water isolation valve upstream was used to secure flushing water to the CHT tank.

Waste drains were directed to the CHT tanks and the pump controllers were set on automatic with the discharges diverted overboard. The pumprooms were allowed to operate in this mode for 24 hours. No drain or operating problems occurred. Soil drains were then diverted to the CHT tanks and the operation monitored for an additional 24 hours.

A briefing session was held for the ships's officers and "R" division personnel to familiarize them with the system. A training demonstration was held showing sewage hose connection and disconnecting procedures.

A final inspection was made and event counters were installed in the pumprooms to count pump firings and to determine wastewater generation rates.

SHIP: USS DONALD B. BEARY (FF-1085)

SYSTEM REPAIRS

VALVES & PIPING

No repairs required

ELECTRICAL

No repairs required

LEVEL SENSORS

10% level sensor at times failed to secure pumps, problem remedied by loosening packing and shortening sensor pigtail.

PUMPS

No repairs required

ALARMS

No repairs required

SYSTEM DOCUMENTATION

PMS, operating instruction plates, and pressure warning plates installed. SDOSS not on board.

SHIP: USS DONALD B. BEARY (FF-1085)

OPERATING SUMMARY

The BEARY's CHT system operates normally in the automatic mode for sewage transfer to shore sewers. There are several operating characteristics which should be noted.

As installed, it is easy to line-up and operate this system. All the diverter valves are accessible and easy to operate, and the pump rooms are easily accessible. The aft pump room is in a controlled supply space (GSK) and requires a key for access.

The CHT tanks appear to have been reversed when installed. The forward tank, being the larger at 1,145 gallons is more than adequate, collecting only the head and wardroom drains from the forward section on the ship. The after tank, though, has a holding capacity of only 545 gallons and is inadequate for the demand put on it. This tank accepts drains from the laundry, the galley, the scullary, and all the heads aft. At 30%, this tank pumps 160 gallons and with the inflow rate of approximately 10 times that per hour, the after system will be considerable overworked as installed.

Throughout the ship, a number of chillwater condensate drains are piped to the CHT system. Most notedly is the chillwater unit in Electrical Control. This line is below the overflow of the forward tank. When the tank fills and overflows, a back-up and flooding of raw sewage occurs. No check valve is installed. Only a small gate valve is installed. Flooding with salt water has occurred in this space.

The hanger deck drains are also piped into the system. In the event of a JP-5 spill from aircraft stored in that space, the CHT system will be contaminated with JP-5.

All AFFF station drains are piped into the CHT collection system. Ship's force stated that these drains have a tendency to overflow when the tank forward overflows. This was not observed by the inspectors.

The ship has four deck risers stations, two forward (port and starboard), and two on the quarters (port and starboard). A pump through capability is available.

The alarm circuits were tested and sound on the Quarterdeck, and in Electrical Central, as well as in each pump room. The audible alarms silence in the pump rooms when the fluid in the tank falls below the 85% level. The alarms on the Quarterdeck and in Electrical Central have to be reset manually.

The urinals are not on constant flush, but a long flush cycle (5 seconds) is used to help prevent scale formation in the drain pipes.

SHIP: USS DONALD B. BEARY (FF-1085)

FROM: 20 Jul 78

WASTEWATER GENERATION DATA

TO: 22 Jul 78

SHIP STATUS in port - 220 men

TEST METHOD Wastewater volume was calculated by tank measurements and pump event counters were installed to count the number of pump firings.

VOLUME REDUCTION ADJUSTMENT

Both soil and waste drains were diverted to the CHT tanks to establish a normal system baseline.

DATA

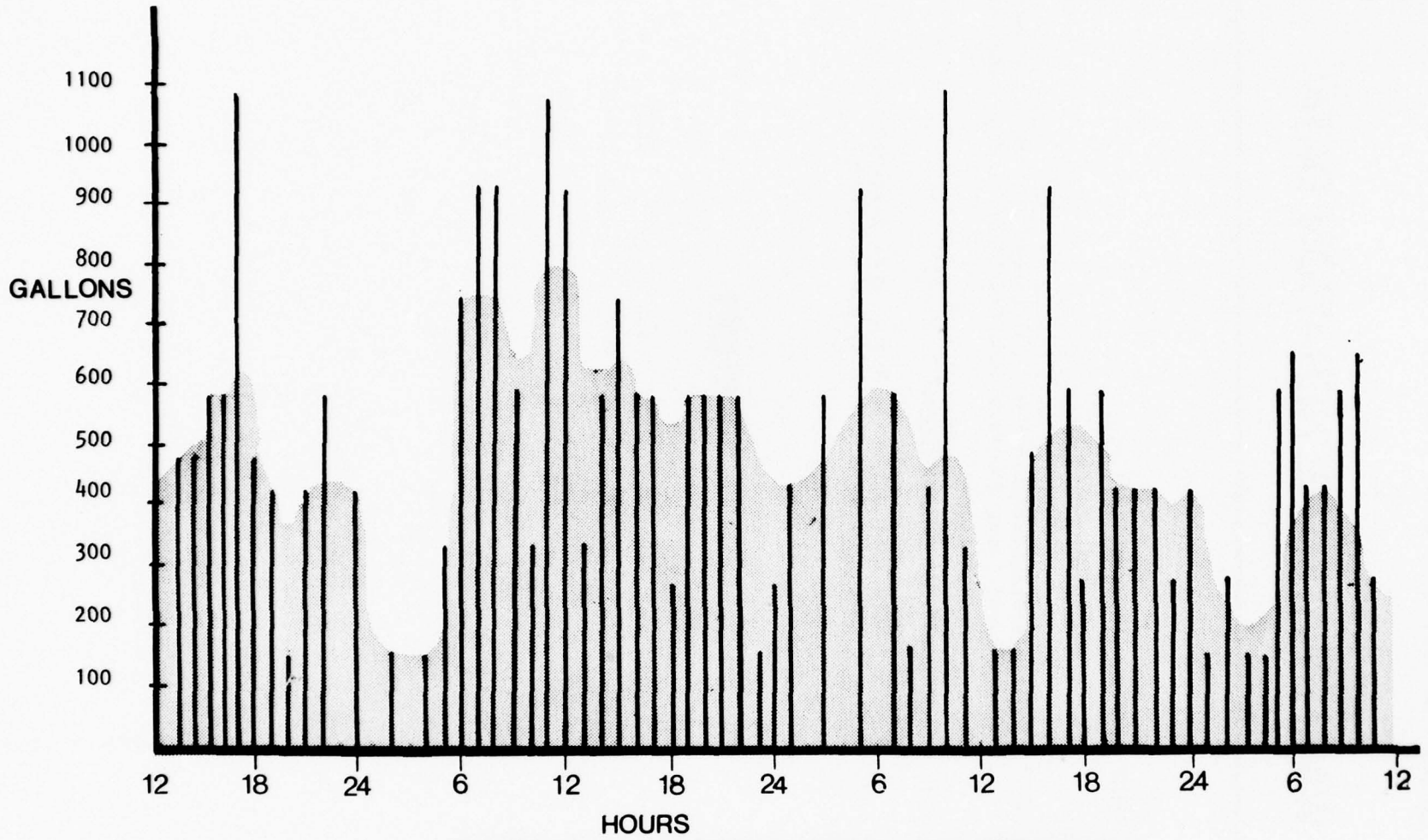
DATE	FWD	AFT	TOTAL
	gal	gal	gal
20 July	3575	7840	11415
21 July	5225	6240	11465
22 July	3575	6400	9975
AVERAGE			10952
			gpcd - 50

Table 1

SHIP: USS DONALD B. BEARY (FF-1085)

FROM: 20 Jul 78

TO: 23 Jul 78



DIURNAL WASTEWATER GENERATION

FIGURE: 1

CONCLUSIONS

Baseline data was gathered from sewage collected from two CHT pump rooms with both soil and waste drains diverted to the CHT tanks. It was not possible to gain any further generation data because of the ship's operations schedule. The baseline data was collected while the ship was in port.

A baseline average of 10,948 gallons per day was recorded. This averages to 49.7 gallons per man per day. Three days of baseline data are shown in Table 1.

The urinals on this ship are not on constant flush, but a long flushing cycle is used.

Figure 1 presents three days of hourly wastewater generation with all drains diverted to the CHT tank. The graph shows a minimum flow of zero (0) gallons per hour to a maximum of 1,075 gallons per hour. Data taken from the installed event counters show the aft system pumping 3 times as many times as the forward system.

The CHT tanks collect the following volumes for each duty pump cycle:

Forward tank duty cycle.....275 gallons
Aft tank duty cycle.....160 gallons

Transit holding time calculations are unavailable due to the lack of data.

The after pump suction piping is installed in such a way that the pump takes a suction from the bottom of the tank, giving the capability of pumping the after tank dry. This is both good and bad for the operation of the system. It is good in that is allows the tank to be emptied completely. It is bad in that the pumps will continue to pump a dry tank if the 10% level sensor fails, causing damage to the pumps. The forward tank suctions are on the side of the tank.

With the AFFF, chill water condensate drains, and the hanger drains piped to the system, care must be taken when operating the system. Overflows of the tanks may cause back-ups, and JP-5 spills may contaminate the system, compounding problems that may be encountered.

As noted earlier, the tank installation on board seems to be reversed based upon the load of the two CHT tanks. The after tank is the smaller of the two, but has the larger demand. Care must be taken when operating the after system because a failure in that system will cause problems more rapidly than in the forward system.

SHIP: USS DONALD B. BEARY (FF-1085)

RECOMMENDATIONS

The data that was collected indicates that the wastewater generation of the BEARY is within the design standards of the system.

For this system to remain in good working order, regular operations is required. It is recommended that this system be used both at sea and in port. Experience has shown that after a time of inactivation, the system is difficult to re-activate. This is due to a number of problems, but they all stem from improper lay-up procedures. If the ship wished to lay-up the system and gravity drain over the side, it is imparative that the system by layed-up properly. Constant operation is recommended.

The following modifications should be considered to enhance the CHT operation and maintenance:

1. Re-pipe the drains for the helo hanger, AFFF stations, and the chiller condensate drains over the side. Install check valves until the re-piping is accomplished.

2. Install a "POWER ON" light on the control panels to indicate to the operator that the control panel is "ON". At this time, there is no indicator other than pushing the "START" button on the control panel.

3. Enlarge the after CHT tank to compensate for the load demand on the tanks. Presently, the inflow is excessive for the tank at its present size.

4. To protect the pumps from pumping a dry tank, run time limiters should be incorporated in the pump wiring circuits.

5. Install ground fault indicators in the level sensor circuits to indicate level sensor failures.

SHIP: USS PORTLAND (LSD-37)

PORT: Little Creek

DATE: 31 Jul **TO** 21 Aug 78

SHIP CLASS ANCHORAGE class LSD

CHT SYSTEM
Comminutor type
2 independent systems, fore and aft tanks with 2 deck risers each
Peabody-Barnes pymps, 150 gpm at 30 psi
Mercury float level sensors

CERTIFICATION Certified by COMNAVSURFLANT letter of 18 August 1978

OPERATING STATUS
Holding tanks and pumps operating as of 9 August 1978

INSTALLATION
DATE December 1975
YARD Norfolk Naval Shipyard

CREW SIZE
AT SEA 387/793(w/troops)
IN PORT 387

TANK SIZE:
Forward--30%-483 gal; 85%-1368 gal; Full-1610 gal.
Aft------30%-675 gal; 85%-1912 gal; Full-2250 gal.
Pump volume

SHIP: USS PORTLAND (LSD-37)

TEST PREPARATION

The PORTLAND was boarded 31 July 1978 in order to activate the installed CHT system. The system was installed during the ship's last overhaul period and has not been operated other than to perform scheduled PMS checks on the system. Pre-activation corrections of several discrepancies were required prior to the initial start-up of the system.

The pumps, controllers, level sensors, valves and associated equipment were inspected for proper operation. Where required, valves and piping were marked for proper content and flow direction.

A failure of the forward 10% level sensor was detected during the testing. Upon investigation, a partial ground and cable break were detected and isolated in the cable between the level sensor and the connection box. Another partial ground was detected in the sensor switch. It was necessary to run a new cable and splice into the level sensor, and to use the red and green side of the level sensor. No other discrepancies were noted in the immediate pumping and controlling equipment.

Both CHT tanks were found to be full of septic sewage during the initial activation. Several days of salt water flushing were required in order to purge and clean the tanks. During this operation, the pumps lost suction a number of times when sludge, dislodged during the flushing, blocked the pump suction lines. Back flushing was required to open these lines.

The forward air blower was activated but had to be immediately secured when the relief valve lifted, releasing atomized septic sewage into the space. An investigation revealed that there had been leakage through the check valve at the tank, allowing sewage to seep into the aeration line. By slowly allowing compressed air into the aeration line, it was possible to purge the line of fluid. The air blower was again activated and tested satisfactorily.

The after air blower was not tested. The silencer had been removed for repairs. The silencer had rusted out completely due to moisture, most likely septic sewage as was found in the forward aeration system, that settled in the silencer over a considerable length of time.

When the operations of the CHT pumprooms was acceptable, salt water was diverted to the tanks for 24 hours using the salt water flushing system. It was necessary to run a fire hose from the berthing compartment 2 decks above the after pump room so a satisfactory flushing could be obtained to the after system. The installed flushing design is unsatisfactory. When the space eductors in the after engine room are in use, only 30 psi of flushing main is available in the after pumproom. After a satisfactory

TEST PREPARATION

flushing period, waste drains were diverted to the tanks for 24 hours to check for any back-ups. No problems were encountered and soil drains were diverted to the tanks. Wastewater generation data meters was installed at this time.

In both pump rooms, the high water alarms were tested and operated satisfactorily. Tank volumes were computed from exterior measurements and from flow meters installed on the sewage discharge hoses.

A briefing session was held with the Commanding Officer, Engineer Officer, CDO's and the "R" Division Personnel on the operation of the CHT System and Personnel Safety.

SHIP: USS PORTLAND (LSD-37)

SYSTEM REPAIRS

VALVES AND PIPING

The soil diverter valve (valve#3-210-2), located in the troop magazine (compartment 3-212-2-m) is not installed. A "T" piece is installed instead. The ship's force has the required valve on board, but is unable to install the valve because ammunition is stored in the magazine and "hot work" is prohibited.

All the remote operating equipment for the diverter valves are unuseable due to stiffness of the valve and the lack of maintenance to the remote operating gear assemblies. Ship's Force personnel are now required to enter the individual spaces to use the valves. Ship's force personnel are correcting these discrepancies.

ELECTRICAL

A new cable run was reuqired for the 10% level sensor on the forward systems. The original cable was partially grounded making the level sensor inoperative.

LEVEL SENSORS

The 10% level sensor was grounded in the black and white switch. The green and red switch was used.

PUMPS/COMMINUTOR

The after bearing of the aft comminutor was wiped and required replacement. No replacement bearing was held onboard.

ALARMS

No repairs required.

SYSTEM DOCUMENTATION

PMS, SDOSS, and data plates are on board.

SHIP: USS PORTLAND (LSD-37)

OPERATING SUMMARY

The PORTLAND's CHT system operates normally in the automatic mode. A pump through capability is available. Both pump rooms are connected to a common deck riser manifold with one deck riser amidships on the starboard side and another on the port side amidships. Both deck risers are in a heavily traveled area and special attention is required when these stations are in use. To ensure that the "dog-ears" on the camlock fittings remain secured, one recommendation is to band and seal these when the hose is attached to the riser. This will prevent the "dog-ears" from opening.

The risers themselves are a considerable distance above the pier level. When the hose is connected to the riser, it must be tied off to ease the weight on the hose on the fitting. Also, just the way the hose lays makes it very susceptible to kinking and chaffing, so care has to be taken to guard against these problems. If available, it is recommended that a fullbore hard rubber be used as the first hose length off the ship instead of the collapsible hose.

In the forward and aft pump rooms, there was evidence of sewage leakage in the aeration lines, particularly when the tanks are full. The check valves that are installed to prevent this are failing and allowing sewage to seep into these lines and settle in the blower silencers. Unless periodic blowing out of these lines is accomplished, a septic condition can arise in this system and, as has already been seen, the silencer deteriorates and fails.

The garbage grinder eductors are piped to the forward CHT tank. If left on, the sewage generation rate in the forward tank is 3 times more than with the eductors secured. Care must be taken to ensure these eductors are secured when not in use.

The majority of the diverter valves for the forward and aft systems are located in locked spaces. Remote operating devices are provided for these valves, but due to lack of maintenance on the valves and on the remote operating gear, these are almost useless. At present, to operate the valves, the operator must go into the locked storerooms.

In the after system, one soil diverter valve (valve #3-210-2) was never installed. A "T" piece was installed instead and when the troop heads are used, there is no way to isolate the soil drains from the tank. The ship's force has the valve on board, but they are unable to install the valve because of ammunition stored in the space where the valve is to be located. All other diverter valves work properly and, with the exception of the above valve, the system can be isolated, if required.

SHIP: USS PORTLAND (LSD-37)

OPERATING SUMMARY

The tank and hose flushing capability for the after system is unsatisfactory. There is not sufficent pressure in this line to do an effective job of flushing. The line draws its flushing water down stream from the main eductors in the after engine room. When the eductors are in use, a maximun of 30 psi of flushing water is available in the pump room. To ensure that a satisfactory flush is obtained, a fire hose must be run from the berthing space 2 decks above the pump room and hooked into the flushing line. As presently designed, to obtain an efficient flush of the transfer hose or the transfer piping, the forward flushing system must be used.

Aeration of the tanks is not being accomplished, thus allowing the tanks to become septic and allowing sludge to form and build up in the tanks. As was seen, the pumps are easily clogged when the sludge breaks loose.

Ships force installed a "POWER ON" indicator light on the control panels in the pump rooms. This has already aided ship's force personnel in detecting when power has been dropped to the control panel.

SHIP: USS PORTLAND (LSD-37)

FROM: 9 Aug 78

WASTEWATER GENERATION DATA

TO: 13 Aug 78

SHIP STATUS In port - 387 men

TEST METHOD Wastewater volume was calculated by tank volume measurements and flowmeters attached to discharge hose. Pump event counters were installed to count the number of firings of the discharge pumps.

VOLUME REDUCTION ADJUSTMENT

Both soil and waste drains were diverted to the CHT tank to establish a normal baseline.

DATA

DATE	FWD gal	AFT gal	TOTAL gal
9 Aug	10143	1350	11493
10 Aug	8211	1350	9561
11 Aug	8211	2025	10236
12 Aug	6279	4050	10329
13 Aug	6762	4050	10812
AVERAGE			10486
			gpcd - 27

Table 1

SHIP: USS PORTLAND (LSD-37)

FROM: 14 Aug 78

WASTEWATER GENERATION DATA

TO: 17 Aug 78

SHIP STATUS 14-15 Aug - In port - 387 men
16 Aug - Underway - 387 men
17 Aug - In port - 387 men

TEST METHOD Wastewater volume was calculated by tank volume measurements and pump event counters attached to the discharge pumps.

VOLUME REDUCTION ADJUSTMENT
The CHT system was collecting soil and waste water. In addition, galley garbage grinders were left on to the FWD tank.

DATA

DATE	FWD gal	AFT gal	TOTAL gal
14 Aug	30429	4050	34,479 *
15 Aug	23184	4050	27,234 *
16 Aug	7245	4725	11,970 **
17 Aug	6279	2700	8,979 ***
AVERAGE			20,666

* - Normal wastewater plus galley garbage grinder eductors
** - Underway - Normal wastewater, eductors secured.
*** - Soil/waste collected until 1100, then soil only

gpcd - 53

Table 2

SHIP: USS PORTLAND (LSD-37)

FROM: 18 Aug 78

WASTEWATER GENERATION DATA

TO: 20 Aug 78

SHIP STATUS In port - 387 men

TEST METHOD Wastewater volume was calculated by tank volume measurements and flowmeters attached to the discharge hose. Pump event counters were installed on each pump.

VOLUME REDUCTION ADJUSTMENT

CHT system was diverted to the transit mode. Only blackwater was collected.

DATA

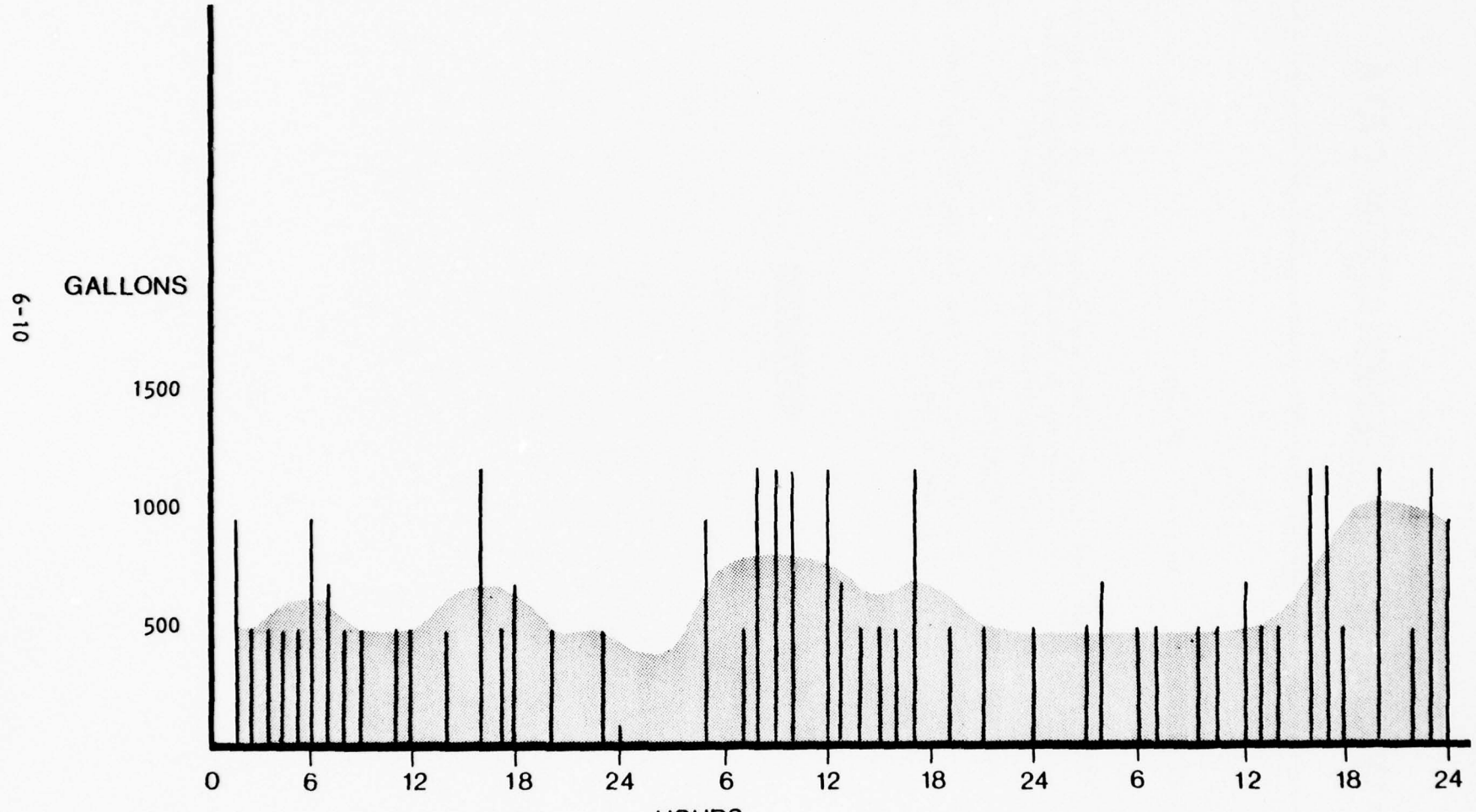
DATE	FWD	AFT	TOTAL
	gal	gal	gal
18 Aug	4830	675	5505
19 Aug	2898	1350	4248
20 Aug	5313	675	5988
AVERAGE			5247
			gpcd - 14

Table 3

SHIP: USS PORTLAND (LSD-37)

FROM: 11 Aug 78

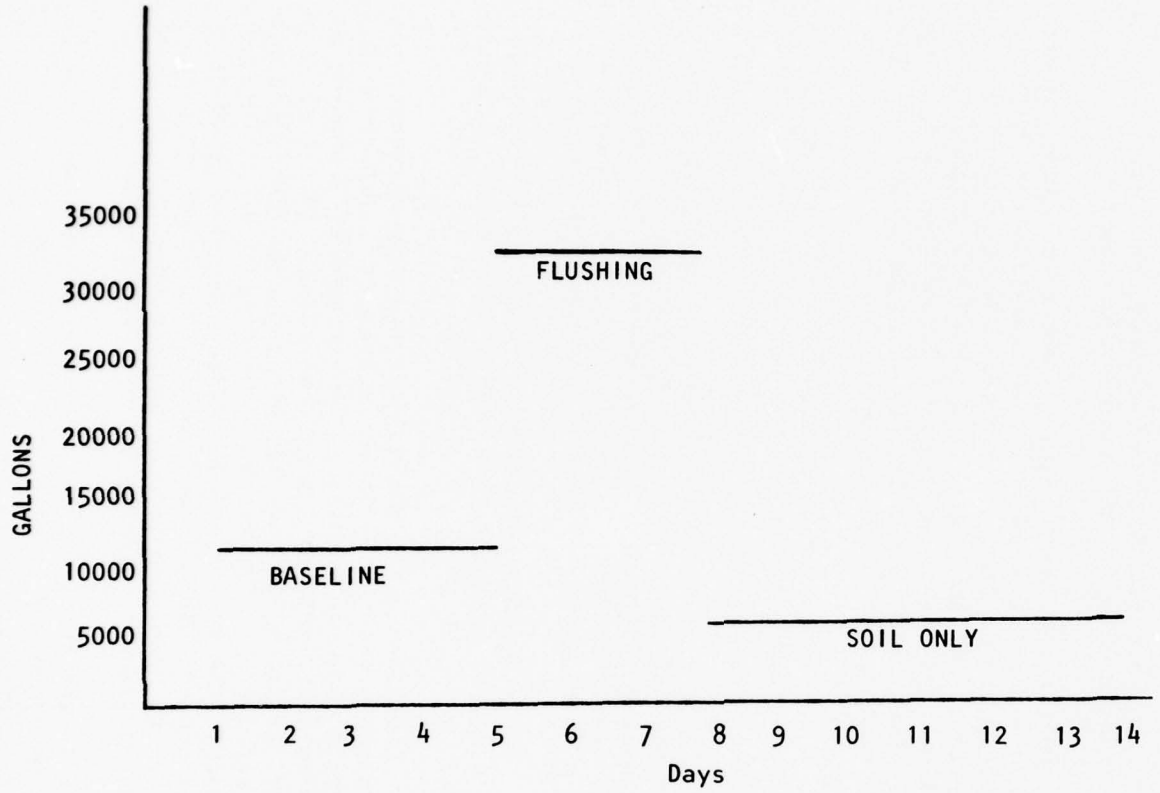
TO: 13 Aug 78



DIURNAL WASTEWATER GENERATION

FIGURE 1

SHIP: USS PORTLAND (LSD-37)



DAILY WASTEWATER GENERATION AVERAGES

FIGURE: 2

SHIP: USS PORTLAND (LSD -37)

CONCLUSIONS

Wastewater generation data for the PORTLAND was gathered from two CHT pump rooms, first with soil and waste drains diverted to the tanks, and then with soil only to the tank. All data except for one day was collected with the ship in port. No urinals were on constant flush. No troops were embarked. Flowmeters were installed on the discharge hose to act as a check of the actual volume pumped.

An accurate measurement of the tank volume was not possible to calculate because no blueprints were available to obtain an accurate degree of slope in the tank. The tanks were not opened because of the septic conditions inside. To obtain a workable volume, the tanks were measured outside, and using the existing Damage Control drawings, the slope was estimated. From these figures a volume number was obtained. To check this number, the flowmeters were used.

A baseline average of 10,486 gallons per day was recorded. This averages to 27 gallons per man per day. Table 1 shows 5 days of baseline data.

Table 2 presents the effects of having saltwater eductors flowing into the CHT tanks. For the two days the eductors ran (14 and 15 August) the average wastewater production was 30,856 gallons or an increase of 294% over the baseline. By this data, it can be concluded that eductors are a large cause for excessive amounts of wastewater.

Table 3 shows an average of 5,247 gallons of soil water per day with waste drains over the side. This averages to 13.5 gallons per man per day.

Diverting waste drains over the side decreased the generation rates in both systems. In the aft system, this reduction in generation could cause an adverse condition. An average of 1 pumping per day of a 2,250 gallon tank leads to septic conditions. If the after system is to be used, aeration is required, particularly when waste drains have been diverted out of the system. The after tank collects drains from the laundry, the scullary (both large gray water producers), the after crew's head, and all the troop heads. When the troops are not embarked, the troop heads are secured and the flow into the aft tank is greatly reduced, thus a decrease in the pumping times.

In the forward tank, there is enough flow into the tank to ensure a good amount of pumpings and a good flow through the tank. Aeration is required, but it is not as critical as in the after system.

CONCLUSIONS

Figure 1 shows three consecutive days of hourly wastewater generation with all drains diverted to the CHT tanks. This graph shows a minimum of zero (0) gallons per hour to a maximum of 1,158 gallons per hour. Peak loading periods are evident from the graph.

Figure 2 shows the average wastewater generation over the data collection period.

Based on the sewage generation data gathered in Table 3, the forward tank produces a maximum of 181 gallons per hour, while the after tank produces 37.5 gallons per hour. At these rates, the transit times until the 85% tank level is reached (soil water only, no troops embarked) are:

Forward.....7.5 hours.
Aft.....50 hours

The CHT tanks collected the following volumes for each duty pump cycle:

DUTY VOLUME

Forward Tank.....483 gallons.
Aft Tank.....675 gallons.

The time period between installation and activation caused conditions that hindered the activation of the system. Some of the major areas encountered were:

1. The septic sewage created a heavey sludge buildup which when dislodged, plugged the suction lines and caused the pumps to lose suction.

2. The aeration system being full of septic sewage, caused by a faulty check valve, caused a health hazard within the pump room when the relief valve lifted.

3. The inadequate flushing pressure in the aft system makes it impossible to flush either the CHT tank or the discharge lines properly.

4. The failure of the 10% level sensor forward caused the pumps to remain running when the tank was empty. If this had happened under other than controlled conditions, the pumps would have been damaged. Presently, there is only a manual securing method (Man 1) after level sensor failure.

CONCLUSIONS

The longer the time period between installation and activation, the more difficult the start-up of the system. This is also true for a system that has been used and then layed up improperly. The same difficulties can be encountered.

SHIP: USS PORTLAND (LSD-37)

RECOMMENDATIONS

The PORTLAND was a difficult ship to activate and it required extra time to complete this segment of the project. The problem areas all stemmed from the length of time between the system's installation and the system's activation. The adverse effects of improper lay-ups, improper maintenance and inadequate design were encountered. It is imparative that these systems are layed up correctly when not in use and that all the diverter valves are identified in such a way as to indicate which position cuts the inflows out of the tanks. One diverter valve in the incorrect position will lead to a septic condition of a secured system.

An area of concern that is appearing more and more as these systems are activated is the inability of the operator to detect when the level sensors are failing. A "ground indicator" lamp should be incorporated in the wiring circuits to give an indication of the level sensor's failure. In addition, a circuit to control the run time of the pumps should be considered so to protect a pump from running dry for a period of time and causing damage to the pump.

The daily generation rates of wastewater by the PORTLAND is well within the design criteria of this system. But, as shown in Table 2, the practice of leaving salt water eductors running when not used can cause the generation rates to exceed the design criteria. Therefore, it is strongly recommended that all saltwater eductors, when not in use, be secured.

It is recommended that the CHT system be operated in its entirety and not secured when at sea. Experience has shown that after a time of inactivity, the system deteriorates requiring additional maintenance. Inproper lay-ups add to the systems deterioration.

The remote operating assemblies are in a poor state of maintenance. These assemblies are provided so an operator does not have to enter a full store-room and try to gain access to the valves, which is required presently. Corrective maintenance is now required because the preventive maintenance was not accomplished.

It is recommended that the installed air blowers be used to aerate this system. The check valves are not keeping the sewage in a full tank from seeping back into the service lines. The PORTLAND's system is installed in such a way that any moisture in the line settles into the silencers. The use of the installed systems will ensure that there is no moisture left standing in the system.

SHIP: USS PORTLAND (LSD-37)

RECOMMENDATIONS

The following modifications should be considered to enhance the CHT system's operation and maintenance:

(1) A ground indicator be installed in the level sensor wiring as discussed above.

(2) The flushing system be re-arranged in the after pump room.

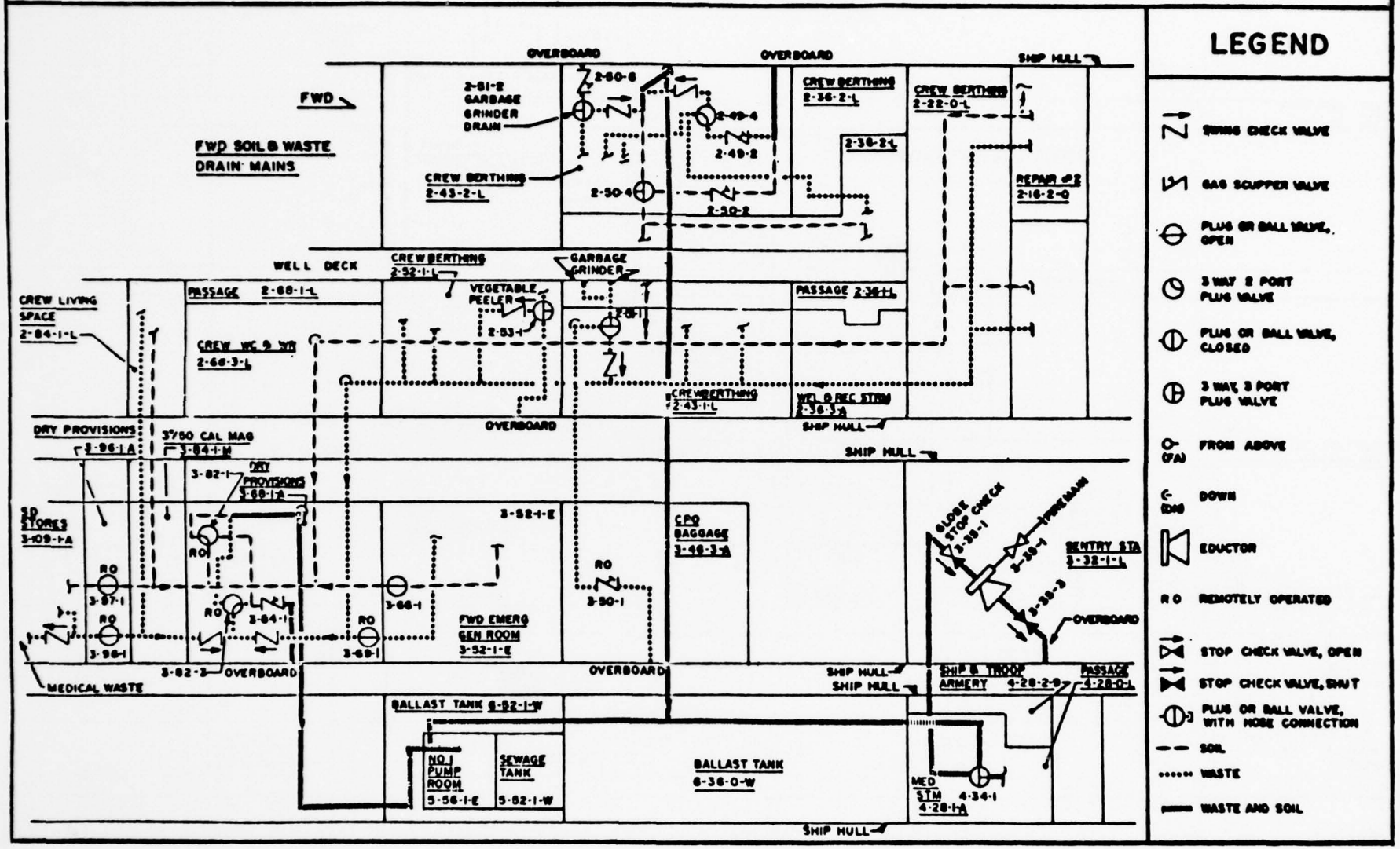
(3) The sections of the SDOSS manual are very hard to follow and understand. Examples of one of these pages is shown in the following appendix.

SHIP: USS PORTLAND (LSD-37)

APPENDIX

DIAGRAM FOR SEWAGE DISPOSAL COLLECTING, HOLDING, TRANSFER SYSTEM TRANSIT ALIGNMENT

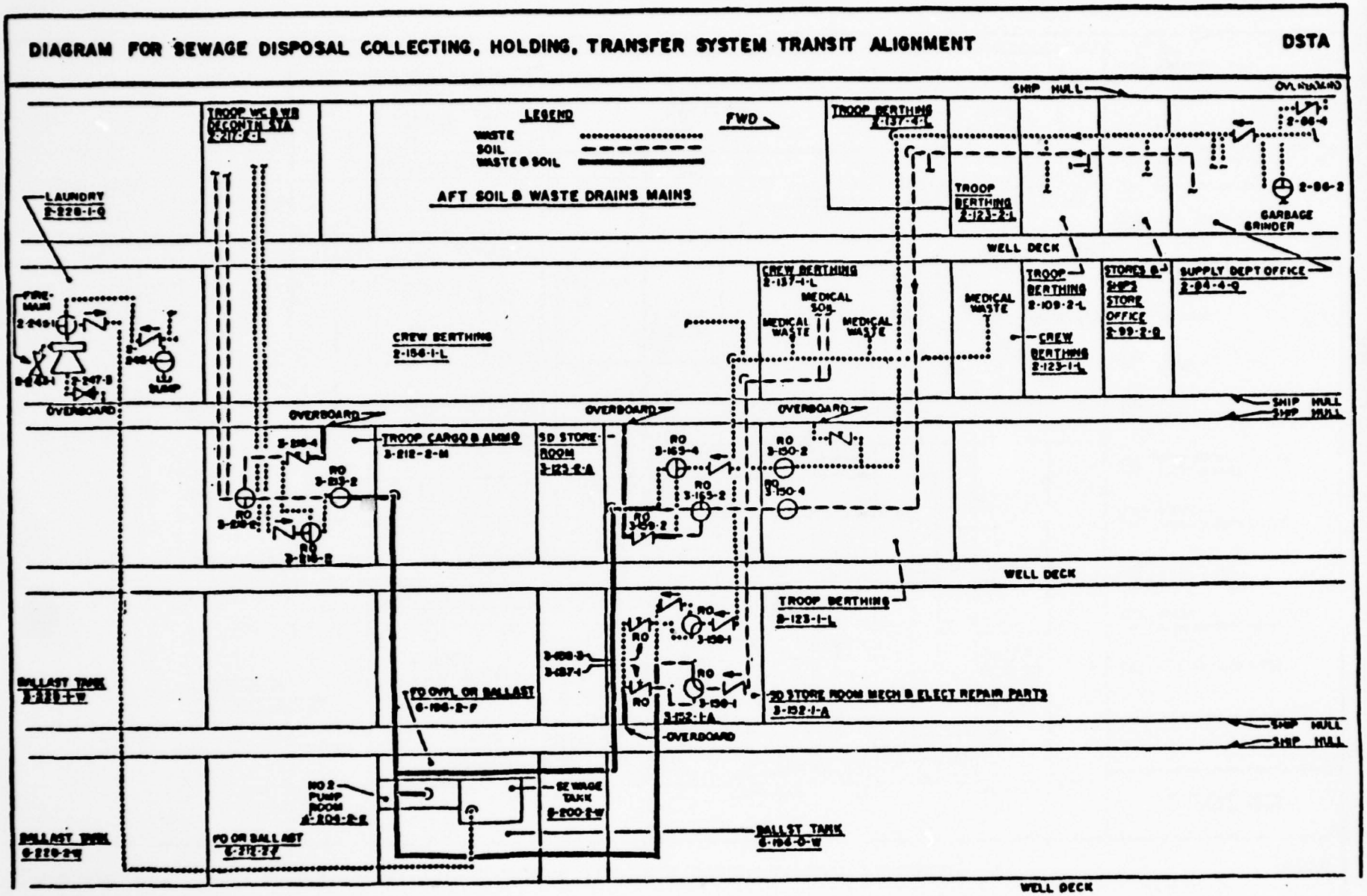
DSTA



LEGEND

- SWING CHECK VALVE
- GAS SCUPPER VALVE
- PLUG OR BALL VALVE, OPEN
- 3 WAY 2 PORT PLUG VALVE
- PLUG OR BALL VALVE, CLOSED
- 3 WAY, 3 PORT PLUG VALVE
- FROM ABOVE (FA)
- DOWN (DN)
- EDUCTOR
- RO REMOTELY OPERATED
- STOP CHECK VALVE, OPEN
- STOP CHECK VALVE, SHUT
- PLUG OR BALL VALVE, WITH HOSE CONNECTION
- SOIL
- WASTE
- WASTE AND SOIL

6-A-1



USS PORTLAND (LSD-37) PUMPING RATE DATA

Forward Tank
One Pump — 30% to 10% Tank Volume
150' Flat 4" Sewage Hose

TEST RUN	TIME (min:sec)	RATE (GPM)	GALLONS (total)
1	----	170	400
2	----	175	900
3	2:35	160	1400
4	3:10	160	1900
5	3:10	160	2400
6	2:25	220	2900

Average Volume 30% to 10% = 483 Gallons

Aft Tank
Two Pumps — 30% to 10% Tank Volume
150' Flat 4" Sewage Hose

TEST RUN	TIME (min:sec)	RATE (GPM)	GALLONS (total)
1	3:20	220	650
2	2:50	250	---
3	2:55	245	---
4	3:10	225	---
5	3:05	210	2700

Average Volume 30% to 10% = 675 Gallons

Both Pump Rooms
Pump Combinations
150' Flat 4" Sewage Hose

TEST RUN	PUMPS (Forward)	PUMPS (Aft)	RATE (GPM)
1	2	2	310
2	1	1	290
3	1	0	190
4	0	1	180
5	Forward Salt Water Flushing		160

SHIP: USS PORTLAND (LSD-37)

WASTEWATER ANALYSIS

The following report was prepared by Hampton Roads Sanitation District on the wastewater characteristics of the PORTLAND during the first use of the Little Creek, NAB pier sewers. Samples were collected by a sampling meter placed in the nearest manhole to the ship. The daily flow numbers were supplied from the daily recorded ship volumes presented earlier in this report.

An increase in chlorides (Cl^-) is noted on 8-14 from 8,094 to 11,267 (mg/l). This is the same day that the salt water eductors were left on and the daily flow increased to 34,479 (GPD). However the drop in chlorides on 8-15 to 3,593 (mg/l) with a continued high flushing rate of 27,234 (GPD) would indicate that a high chloride count level is not necessarily the result of high saltwater flows and may be more a function of the daily salinity of Little Creek Cove effected by freshwater runoff.

The chloride content of ship generated wastewater is of particular interest to Hampton Roads Sanitation District because of the close proximity of the Chesapeake-Elizabeth sewage treatment plant to Little Creek, NAB. If the chloride level is excessive from ship wastewater there may not be sufficient dilution from domestic wastewater before reaching the treatment plant.

Commonwealth of Virginia

HAMPTON ROADS SANITATION DISTRICT

BOX 5000

VIRGINIA BEACH, VIRGINIA 23455

WILLIAM J. LOVE, P. E.
GENERAL MANAGER
MAURICE A. PERSON, P. E.
ASST. GEN. MGR. &
DIR. OF ENGINEERING
MRS. ANNA MARIE BOTTOMS
SECRETARY
JAMES R. BORBERG, P. E.
DIR. OF CONSTRUCTION
EUGENE K. GOFFIGON
DIR. OF TREATMENT
ROBERT H. PORTER, JR.
DIR. OF FINANCE & ADMINISTRATION
DONNIE R. WHEELER
DIR. OF WATER QUALITY

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WILLIAM T. PARKER
S. WALLACE STIEFFEN
CHESLEY H. McGINNIS

September 6, 1978

Mr. Sol Schwartz
P.A. Engineering
308 West Free Mason St.
Norfolk, VA 23501

Dear Mr. Schwartz:

Enclosed please find the results of analyses performed on composite wastewater samples taken of wastewaters generated by the U.S.S. Portland for the period August 10 through August 15, 1978.

If you require any additional information, please feel free to contact me at any time.

Thank you for your cooperation in this matter.

Sincerely,

Guy M. Aydlett
Chief, Industrial Waste
Division

tlm/GMA

LITTLE CREEK AMPHIBIOUS BASE - SHIPBOARD WASTE

U.S.S. PORTLAND

Date of Sample	Flow (GPD)	pH	BOD (mg/l)	SS (mg/l)	Oil & Grease (mg/l)	Cl^- (mg/l)	TOC (mg/l)	Phenols (mg/l)
8-10	9,561	6.43	244	158	--	5,827	--	1.79
8-11	10,236	6.74	249	182	49	5,342	--	0.56
8-12	10,329	--	--	--	--	--	--	--
8-13	10,812	6.85	170	224	66	8,094	92	0.40
8-14	34,479	7.21	61	125	11	11,267	64	0.46
8-15	27,234	7.01	112	116	31	3,593	128	0.27

METALS

Date	Cr (mg/l)	Cu (mg/l)	Zn (mg/l)	Pb (mg/l)	Ni (mg/l)	Cd (mg/l)	Fe (mg/l)	Hg (ug/l)	Ag (mg/l)
8-10	_0.09	1.46	0.46	_0.36	0.22	_0.01	2.11	0.28	_0.03
8-11	_0.09	1.16	0.37	_0.36	0.20	_0.01	1.25	0.14	_0.03
8-12	NS	NS	NS	NS	NS	NS	NS	NS	NS
8-13	_0.09	1.69	_0.09	_0.36	0.17	_0.01	1.16	_0.01	_0.03
8-14	_0.09	0.76	_0.09	_0.36	0.15	_0.01	0.83	_0.01	_0.03
8-15	_0.09	0.78	_0.09	_0.36	0.12	_0.01	0.72	_0.01	_0.03

SHIP: USS PAPAGO (ATF-160)

PORT: Little Creek

DATE: 25 Jul **TO** 23 Aug 78

SHIP CLASS APACHE class ATF

CHT SYSTEM Strainer type
1 system amidships with port and starboard deck risers
Peabody-Barnes pumps rated @ 100 gpm at 50 feet head
General Electric 230 volt DC motors and controllers
Mercury float level sensors

CERTIFICATION

Pending Ship Confirmation

OPERATING STATUS

Holding tank and pumps operating as of 28 July 1978

INSTALLATION **DATE** September 1977
YARD Norfolk Shipbuilding and Drydock Co.

CREW SIZE **AT SEA** 55
IN PORT 55

TANK SIZE 1350 gallons

PUMP VOLUME 225 gallons per firing

SHIP: USS PAPAGO (ATF-160)

TEST PREPARATION

The USS PAPAGO (ATF-160) was boarded on 25 July,1978 to activate the CHT system and to collect data on sewage collection. No system repairs were required in activating the system. The only discrepancy noted was one soil diverter valve (#3-34-2) for the soil drains from the CPO head had been installed backwards so that when the valve was diverted to the CHT tank, the inflow line from the head was blocked and a fluid back-up in the head resulted. Ship's force personnel removed and reversed the valve.

The entire piping system was traced with ship's force personnel to locate all the soil and waste diverter valves and to check the general condition of the piping runs. The only area of concern is that the pump overboard discharge piping is located 6 inches below the water line, allowing a possible flooding condition.

With all soil and wastes drains diverted over the side, the system was activated using a continious saltwater flush. The system was allowed to remain flushing for 6 hours to check the reliability of the system. A continious 24 hour flushing was not used because of the load that was put onto the ship's duty fire pump. Soil and waste drains were then diverted to the tank and all drained without any backup.

The power for the pumps and the control panel is 230 volts DC. As a result the wiring configuration of the control panel is different from the normal 120 volt AC control panel and the single event counter arrangement to record duty pump cycles could not be used. Three 230 volt DC counters were required to record the duty pump firings. One counter was wired to each pump relay to record each pump firing. A second counter was wired between the pump relays to record the number of double pump firings caused by the bouncing action of the 30% level sensor. The total duty pump firings were calculated by subtracting the number of double firings from the total of the two pump firings. A schematic of the counter installation is shown in the appendix.

SHIP: USS PAPAGO (ATF-160)

SYSTEM REPAIRS

VALVES & PIPING

Pipe runs were incorrectly marked for flow direction and content. Proper markings were made as the lines were traced. Diverter valve #3-34-2 was origionally installed backwards. Ship's force changed out valve.

ELECTRICAL

The controller for #1 pump failed and burned off the contacts due to the failure of the 30% sensor. Ship's force changed out the controller/contacts.

LEVEL SENSORS

The 30% level sensor failed after 1 week's operation due to a short in the cable. The level sensor was re-wired using the green and red leads in the cable.

PUMPS

None

ALARMS

None

SYSTEM DOCUMENTATION

SDOSS, PMS, and pressure warning placards are in place. Health warnings are on board.

SHIP: USS PAPAGO (ATF-160)

OPERATING SUMMARY

The PAPAGO's CHT system operates normally in the automatic mode for transfer to the shore sewers. There are no operating pecularities in this system. The diverter valves are easy to operate and are accessible, with the exception of the waste and soil diverter valves for the CPO's quarters which is located in a locked storeroom.

There is only one isolation valve in the entire system, located on a waste drain from the ship's medical office. This valve is also located in a controlled space (GSK).

The PAPAGO has no pump through capability because there is a Port/Starboard diverter valve in the pump deckriser line instead of a "T" piece.

There are no provisions made for a hose flushing capability.

The control panel and motor operating circuits are 230 volts DC. There is no local circuit breaker for the control panel within the pumproom. The power must be secured at the main switchboard in Main Control (B-2). During the operation of the controller, considerable arcing is present as the relays operate. Heavy pitting of the contacts is most likely to occur.

The alarm circuit is 115 volts AC and is energized from Main Control. The alarms sound in Main Control, on the Bridge, and in the pumproom. There are both lights and bells at all of these stations with a cutout to silence the audible alarm. All the alarms automatically reset when the tank level drops below 85%.

All laundry, galley and garbage grinder drains are piped to the holding tank. Two urinals are constantly flushing with a flow rate of approximately one gallon per minute because of faulty flushometers. The remainder of the urinals are not on constant flush.

The overboard discharge for the pumps is located 6 inches below the waterline at frame 35 on the starboard side. The discharge line, therefore, is constantly full up to the checkvalve on the discharge side of the pumps. By listening to the pipe, water was heard to be trickling past the check valve and flowing back into the tank via the pumps. From a safety standpoint, the discharge

should be above the water line in accordance with GENSPECS.

After one week of operation, the 30% level sensor failed and remained in a CLOSED position. At 10% the pumps secured normally, but when the level rose above the 10% level, the pumps started, causing a short cycle of the pumps. The sensor failure occurred as the PAPAGO was underway for her normal operations. The rolling of the ship caused the #1 pump to short cycle at such a high rate that the motor controller failed and burned out. Since the 30% level sensor remained in a CLOSED position, there was no cycling of the duty and standby pumps.

A second motor controller failure occurred approximately one week later as the PAPAGO again was underway. For an undetermined reason, the #5 CR control relay burned out and failed. The cause of this failure is not known at this time.

SHIP: USS PAPAGO (ATF-160)

FROM: 17 Aug 78

WASTEWATER GENERATION DATA

TO: 22 Aug 78

SHIP STATUS In port from 17-18 August; Underway 19 August
In port 20-22 August. 55 Men

TEST METHOD Wastewater volume was calculated by tank volume measurements and pump event counters installed to count the number of discharge pump activations.

VOLUME REDUCTION ADJUSTMENT

Both soil and waste drains were diverted to the CHT tank to establish a normal baseline.

DATA

DATE	TOTAL gal
17 August	5625
18 August	5400
19 August	5175
20 August	5175
21 August	5850
22 August	6075
AVERAGE	5550
	gpcd -101

*Underway

Table 1

SHIP: USS PAPAGO (ATF-160)

FROM: 23 Aug 78

WASTEWATER GENERATION DATA

TO: 28 Aug 78

SHIP STATUS In port 23 August; Underway 24 and 28 August. 55 Men
No usable data available for period 25-27 August.

TEST METHOD Wastewater volume was calculated by tank volume measurements and pump event counters on each pump.

VOLUME REDUCTION ADJUSTMENT

The CHT system was diverted to the transit mode.
Only black water was collected.

DATA

DATE	TOTAL gal
23 August	3825
24 August	4725
28 August	3825
AVERAGE	4125
	gpcd - 75

Table 2

AD-A068 556 PA ENGINEERING CORTE MADERA CA F/G 13/10
CHT SHIP/SHORE OPERATIONS ASSESSMENT. VOLUME II. APPENDIX B,(U)
DEC 78 R W URBAN, P E CARR, S H SCHWARTZ N00014-78-C-0345
UNCLASSIFIED NL

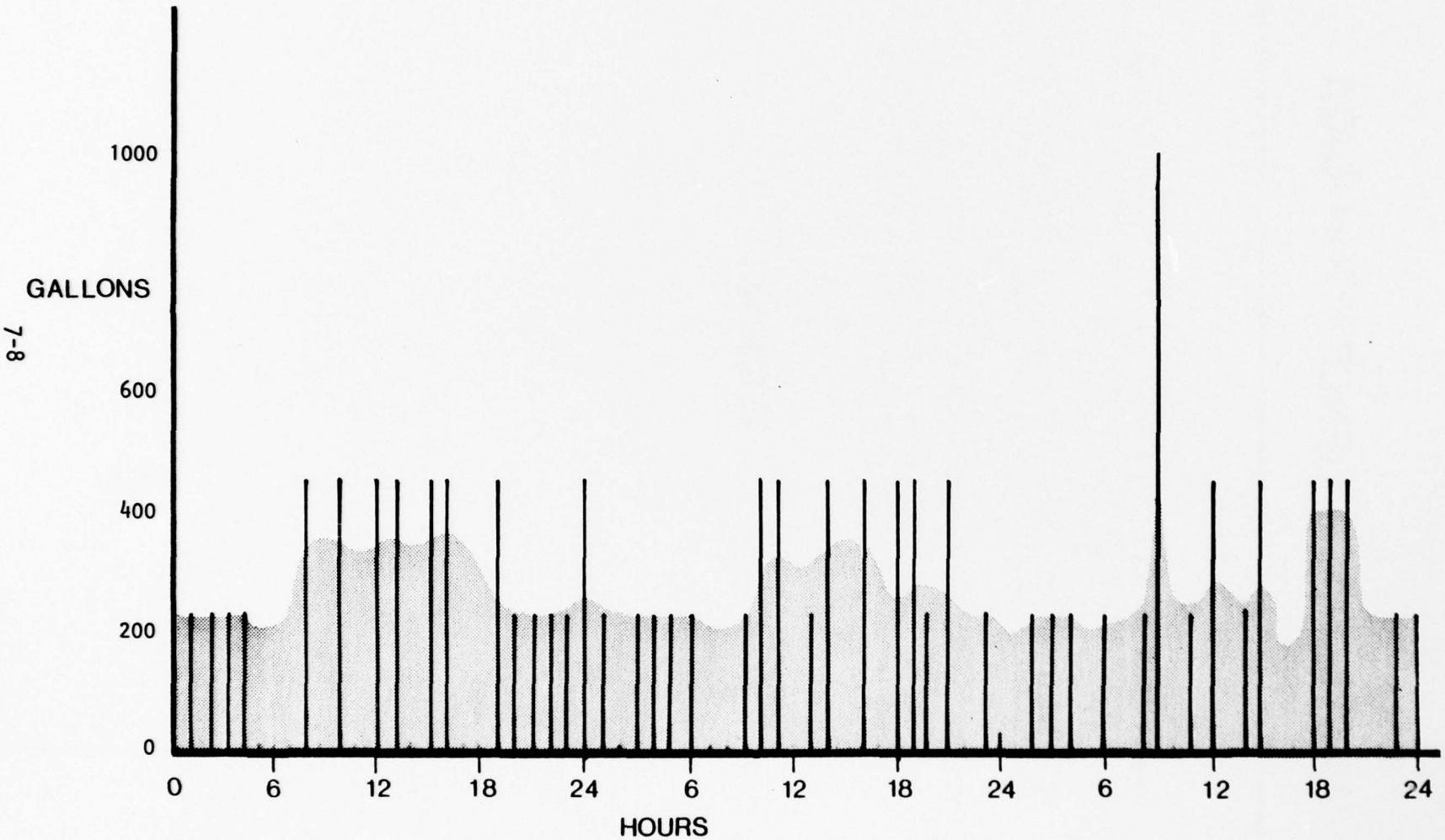
2 OF 2
AD
A068556

END
DATE
FILMED
6-79
DDC

SHIP: USS PAPAGO (ATF-160)

FROM: 18 Aug 78

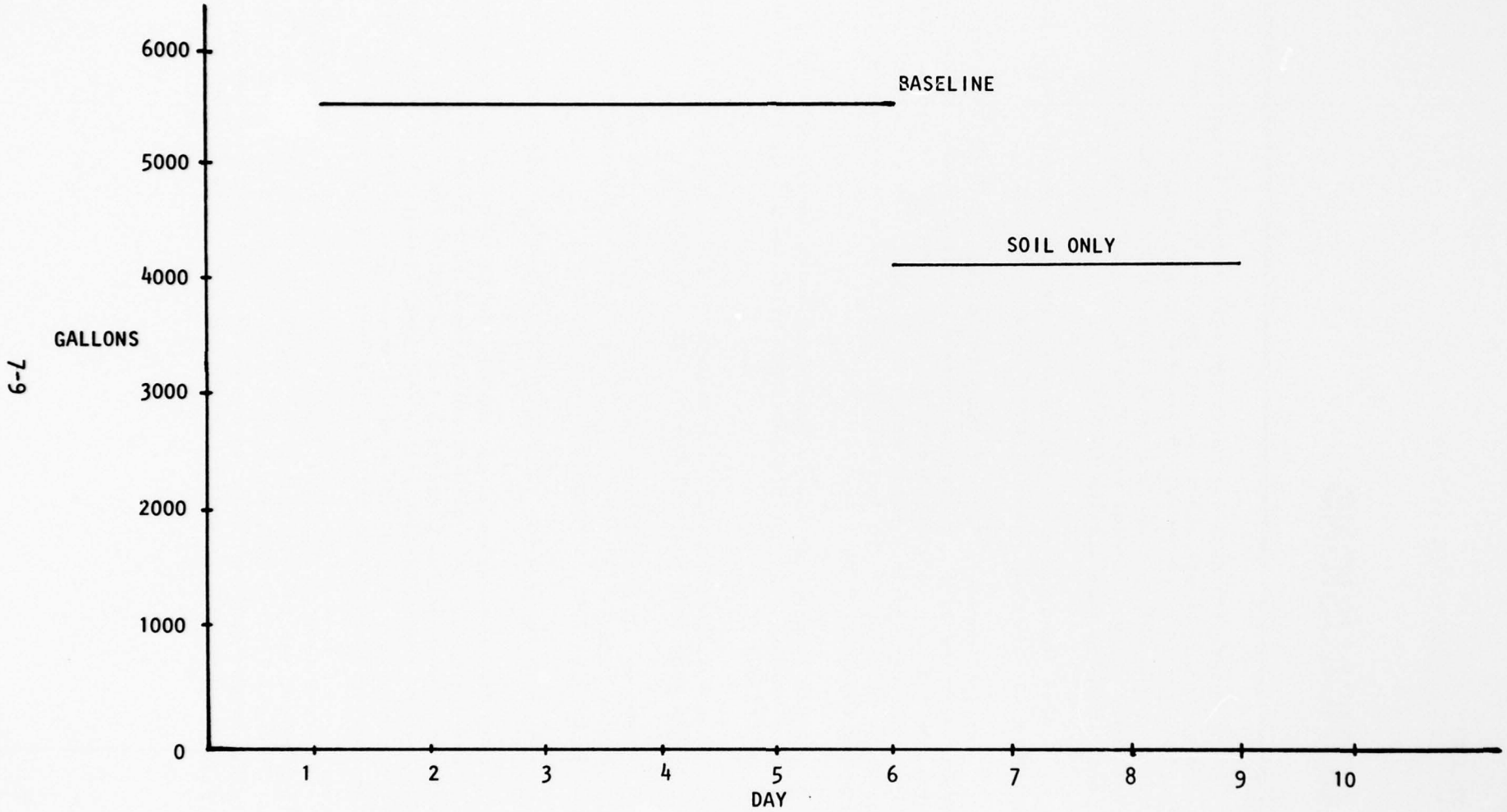
TO: 20 Aug 78



DIURNAL WASTEWATER GENERATION

FIGURE 1

SHIP: USS PAPAGO (ATF-160)



DAILY WASTEWATER GENERATION

FIGURE: 2

SHIP: USS PAPAGO (ATF-160)

CONCLUSIONS

The generation data was collected with the CHT system operating in different modes of operation and with the ship both inport and underway. The baseline information was obtained by diverting all soil and waste drains to the CHT tank where they were collected and pumped overboard. Next, only the soil drains were diverted and collected to determine a transit holding time for the PAPAGO.

A baseline average of 5,550 gallons per day was obtained. This averages to 101 gpcd. Table 1 shows 6 days of data.

The data shown in Table 2 shows the effect of diverting waste drains over the side. 3 days of useable data are shown. An average of 4,125 gpd was noticed, a drop in little over 25% in average generation. The per capita average drops to 75 gpcd. The effects of the constant flushing of the two urinals results in a less than expected drop in the generation rates.

Figure 1 shows the hourly generation rates for a period of 3 consecutive days. An average generation rate of 228 gallons per hour was recorded.

Figure 2 shows the baseline average of 5,550 gpd and an average of 4,125 gpd when only the soil drains were collected.

Based on the information obtained in Table 2, the average hourly generation rate is 172 gph. At this rate, the transit holding time until the 85% level is reached is 6.6 hours.

The pumping rate for the PAPAGO is 225 gallons per pump firing.

The PAPAGO experienced two controller failures while operating the CHT system at sea. Both appear to be either directly or indirectly related to wave action within the tank caused by the rolling of the ship. Since there are no baffles within the tank to control the free surface effect, the wave action within the tank can give a false indication to the level sensors of the actual fluid level within the tank.

In the case of the first controller failure, the primary cause of the failure was the malfunction of the 30% level sensor. When the fluid level reached 10%, the wave action caused the 10% level sensor to bob around causing the level sensor mercury switch to open and close in quick succession, resulting in the failure of the #1 motor controller.

SHIP: USS PAPAGO (ATF-160)

CONCLUSIONS

In the second failure, all indications are that wave action again played a part in the failure. It is suspected that the 30% level sensor bobbed due to the wave action causing quick heavy power surges across the 5 CR control relay. The final result was an overload condition which caused the failure of the relay.

Failure of this sort can be expected to happen in systems that have high rates of wave action in them. Relays that are subjected to rapid cycling will fail because of the high voltage surges that cross them as they operate.

SHIP: USS PAPAGO (ATF-160)

RECOMMENDATIONS

The daily sewage generation rate of the PAPAGO is in excess of the 60 gpcd standard. It is suspected that the constant flushing of the two urinals contributes significantly to the high generation rates. This demonstrates that higher than expected generation rates can be seen due to flushometers settings.

The system installed aboard the PAPAGO cannot be used underway. Without baffle walls in the tanks, the wave action in the tank gives false level indications to the level sensors. It is recommended that baffle walls be installed in the CHT tanks of this size ship to lessen the wave action within the tank as the ship rolls.

A design change in the circuitry of the control panel should be considered. Presently, when the 30% level sensor bounces because of wave action within the tank, the control relays in the control panel begin to operate erratically. This erratic operation causes overloads on the control relays and double pump firings. Consideration should be given to deactivating the 30% level sensor once it has operated until it is reset by the opening of the 10% level sensor at the end of the pumping cycle. The results of the bouncing on the PAPAGO's high voltage system can be seen in two relay failures.

In addition to the above, the following should be considered to enhance the operation of the PAPAGO's CHT system.

1. Change the position of the pump overboard discharge so that it is above the water line and in accordance with GENSPECS.

2. Install a local circuit breaker for the control panel within the pump room. Presently, the only circuit breaker for the system is on the Main Switch Gear in Main Control. This should be regarded as a SAFETY discrepancy as now designed.

3. An indicator light should be installed on the control panel to give an "OFF/ON" status of the control panel.

4. A fault detector should be incorporated into the level sensor circuitry to indicate problems with the level sensors. As has been noted, a failure of a level sensor can go undetected and can cause damage to the system.

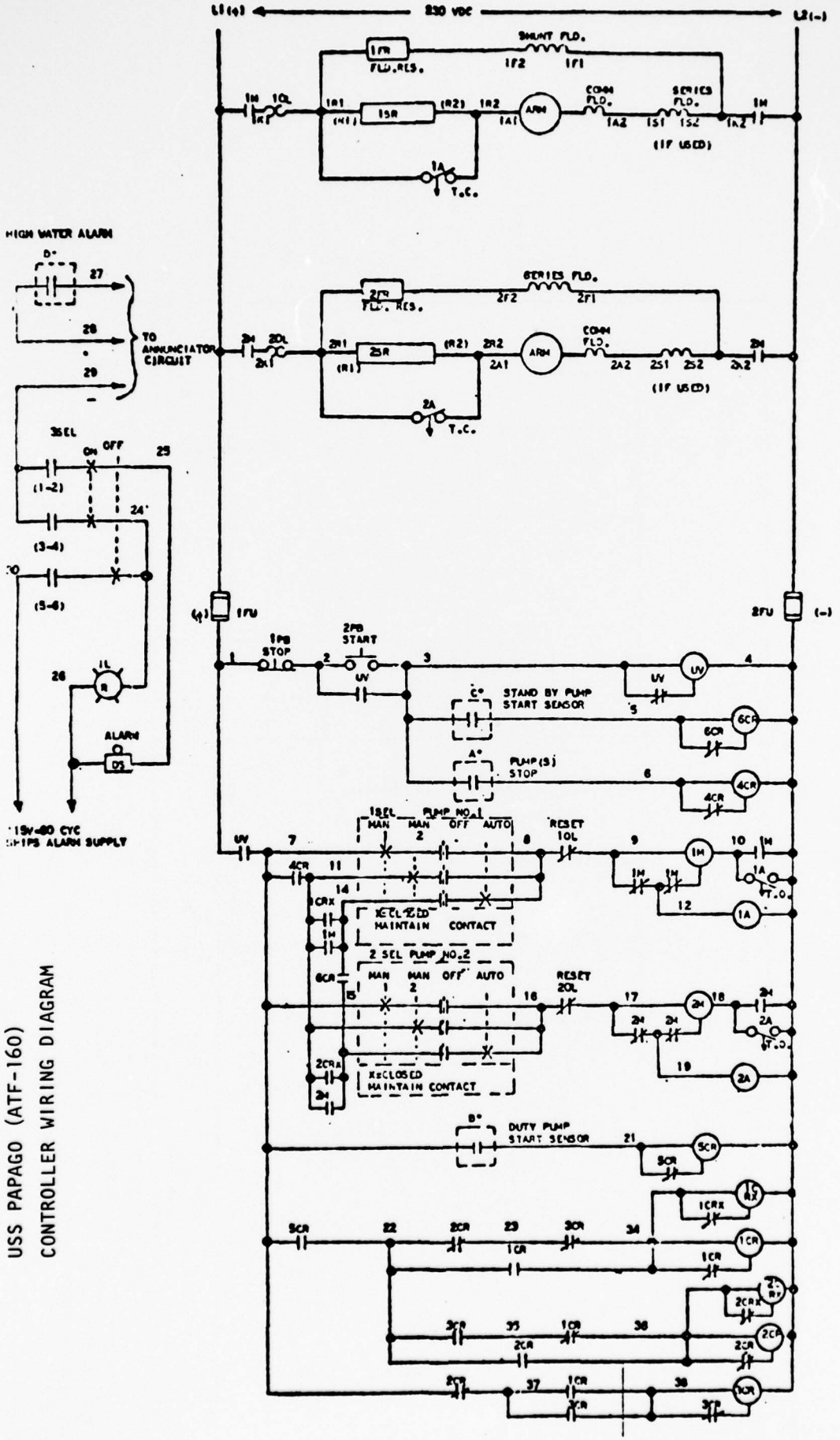
5. The "Port/Starboard" deck riser diverter valve should be replaced with a "T-piece" to provide a pump through capability.

RECOMMENDATIONS

6. A sight-tube should be incorporated to give a direct fluid level reading in the tank. As is presently designed, the only way to ensure the tank is empty is to wait until the discharge pumps begin to cavitate. A level sensor failure can give a false indication, as noted with the 30% level sensor failure on the PAPAGO.

SHIP: USS PAPAGO (ATF-160)

APPENDIX



USS PAPAGO (ATF-160)
CONTROLLER WIRING DIAGRAM

FIGURE: A-1

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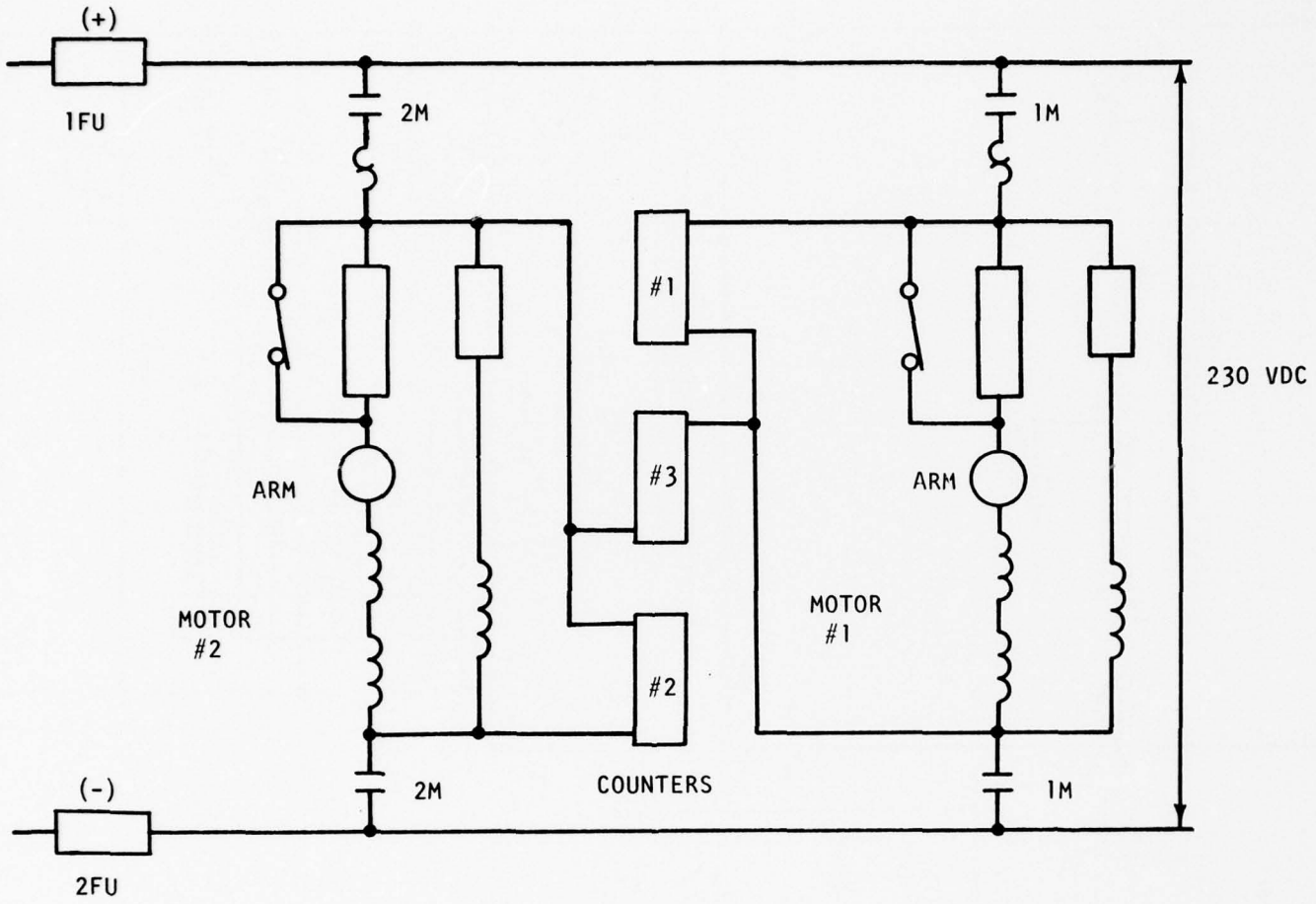
SHIP: USS PAPAGO (ATF-160)



7-A-2

SCHEMATIC OF DC PUMP EVENT COUNTERS

FIGURE: A-2

SHIP: USS SAGINAW (LST-1188)

PORT: Little Creek

DATE: 29 Aug **TO** 21 Sept 78

SHIP CLASS NEWPORT class LST

CHT SYSTEM Communitor type
Two independent systems with two discharge risers at midships (port and starboard) for the forward system and one discharge riser aft (starboard quarter).
Peabody Barnes Pumps rated at 100 gpm at 70 ft. head
Mercury float level sensors.

CERTIFICATION Provisionally certified by CNSL 16 March 1978

OPERATING STATUS

Holding tank and discharge pumps operating as of 31 August, 1978

INSTALLATION

DATE January 1977

YARD Horne Brothers, Newport News, Va.

CREW SIZE

AT SEA 210 (crew only)/500 (with troops embarked)

IN PORT 210 crew

TANK SIZE

FWD-30% - 1,100 gallons, 60% - 2,200 gallons, 85% - NA, Full-3,700 gallons, Duty pump volumes
AFT-30% - 690 gallons, 85%-1,955 gallons, Full-2,300 gallons, Duty pump volumes

SHIP: USS SAGINAW (LST-1188)

TEST PREPARATION

On 29 August, the USS SAGINAW (LST-1188) was boarded to activate the installed CHT system and to collect sewage generation data. An investigation of the pump rooms and other spaces with CHT valves and pipings did not reveal any obvious problems.

The next step in the activation was to fill the CHT tanks to check the proper operation of the level sensors. In the forward system, the 10% and 30% level sensor worked as required. A level sensor failure was noted when the tank level reached the 60% level sensor. The water level in the tank was lowered to the 10% level and the 60% level sensor was removed for inspection. Upon removal, it was noted that the bobbin of the level sensor was missing and all that was protruding into the tank was a bitter end of the broken wire. A stock check was made on board to determine if a spare level sensor was held in stock. A spare level sensor was not carried on board.

A continuity check was made on the 85% level sensor and the continuity showed that a partial ground or a closed switch was showing in the 85% level sensor circuitry. This level sensor was removed at the same time as the 60% level sensor. The problem was that the bobbin of the level sensor was caught in the overhead piping of the CHT tank. The stuck bobbin was freed and another continuity check was performed on the circuitry. This check proved satisfactory. The continuity on both the black and white leads and the red and green leads was checked and both sets of leads showed an open circuit.

The sensor at the 85% level was removed and reinstalled in the 60% level sensor location. The new 60% level sensor was wired in such a way that the alarm and the standby pumps activate at 60%. The old 60% level sensor flange and the bitter end of the level sensor cable were used to close the access for the 85% level sensor. The water tight integrity was maintained by stuffing the access hole through the flange with the old 60% level sensor cable.

Upon completion of the temporary repairs, the tank level was again brought up to 60%, and the alarm and the standby pump activated as required. (Note: The alarms activated at the remote stations only. See below.) The level was raised above the 85% level sensor to check for water tight integrity. This proved to be satisfactory.

The test procedures for the level sensors were the same in the after system as were used in the forward system. All the level sensors in the after system performed satisfactorily and no repairs were required.

When the alarms were tested, the alarms rang in Main Control and on the

SHIP: USS SAGINAW (LST-1188)

TEST PREPARATION

Quarterdeck, but failed to activate within the pump rooms themselves. The ship's force were notified of the problem and are investigating the problem and will correct the discrepancy.

Both tanks were pumped down to the 10% level using the automatic mode of the CHT system. The tanks were opened for inspection to determine the interior condition of the tanks and to check the wash down and aeration components within the tank. In both the tanks, the aeration and wash down components were found to be in satisfactory condition. The preservation of the tank was satisfactory. In the forward tank, there was no evidence of the damaged 60% level sensor float. The tanks were closed and again filled to above the access plates to check for water tight integrity of the tanks. This check was satisfactory.

The tanks were put on constant salt water flush for approximately six hours to check the operation of the controllers. Satisfactory results were obtained and gray water drains were diverted to both the CHT tanks for a 24 hour period to further check the operation of the system. In addition, event counters were installed into the pump control circuitry to count the number of pump firings during this part of the test. Upon the successful completion of the gray water phase, black water drains were diverted to the tanks. The entire system was put on automatic and diverted to pump over the side. It was not possible to pump to the pier sewers because the Little Creek facilities were not ready for use.

An instruction period was held with the personnel of R-Division and A-Division to familiarize them with the operation of the CHT system.

The event counters that were installed earlier began to collect sewage generation data from each of the pump rooms. The generation volumes produced were determined by tank measurement and the number of times each pump fired.

SHIP: USS SAGINAW (LST-1188)

SYSTEM REPAIRS

VALVES & PIPING No repairs were required in the pump rooms or on any of the inflow piping. The after deck riser is damaged and requires replacement. The ship's force has a work request submitted to their repair activity to manufacture and install the damaged piping. The ship's force has the deck riser isolation valves and camlock fittings on board. The forward space eductor does not take a suction. A clogged suction line is expected to be the cause.

ELECTRICAL No repairs were required.

LEVEL SENSORS The 60% level sensor in the forward system failed to operate. Removing the sensor revealed that the entire float switch assembly of the level sensor was missing. The temporary repair was made by switching the 85% level sensor and the 60% level sensor. The 85% level sensor plate and packing nut were stuffed to insure a watertight integrity.

PUMPS No repairs were required.

ALARMS The alarms failed to sound and failed to activate the alarm light in the pump rooms. Audible alarms were activated at the Quarterdeck and Main Control. The ship's force personnel are investigating the cause of the alarm malfunction in the pump rooms. As of this report, no reason for the failure has been found.

SYSTEM DOCUMENTATION

The PMS, the operating instruction plates and the SDOSS are on board and installed. The pressure warning plates are not on board. The ship has a work request in to have these plates manufactured.

SHIP: USS SAGINAW (LST-1188)

OPERATING SUMMARY

The SAGINAW'S CHT system operates normally in the automatic mode for transfer to shore sewage. The diverter valves and bulk head stops are easily accessible and operate freely. Remote operating gear, where required, also operates freely. The overboard check valves were replaced with gag scupper valves by ship yard personnel to complete the installation SHIPALT.

As noted in the test preparation section, the alarm circuits were tested and operated satisfactorily at the remote stations, but unsatisfactorily in the pump rooms themselves. The alarms sounded on the Quarterdeck and in the Main Control Station. There is no remote alarm provided in the Log Room. The audible alarms deactivated when the fluid level in the tank dropped below the alarm level sensors, but the alarm bullseye in Main Control had to be reset manually.

The laundry and galley drains are piped to the forward CHT system. As is true in other ships of this class, the laundry is a high producer of gray water. Five of the 17 urinals aboard the SAGINAW are on constant flush. The SAGINAW has a history of the urinals backing up due to scale formation in the piping.

Again, as is common in ships of this class, the brig heads are below the overflow piping for the after CHT tank. The drains from this space MUST be diverted as soon as the high level alarm sounds to prevent a back up into this area.

A pump through capability is available at the forward CHT connections. Aft, there is no pump through capability because of the riser placement (one riser on the starboard quarter). A ship outboard will have to run a hose across the fantail of the SAGINAW to pump to the pier. At the time of activation ,the aft deck riser was damaged and was being replaced. Until repaired, there is no capability to pump ashore aft.

With the temporary placement of the 60% level sensor in the forward system, the alarm now sounds at the 60% level rather than the 85% level as is normal in these systems. Along with the alarm activation, the stand-by pump will also activate at the 60% level sensor. A replacement sensor is being ordered.

Both aeration systems were tested and found to be in satisfactory working condition. The controller for the after aeration system appears to have a bad switch and to activate the air blower aft, the operator has to push the "Start" and "Reset" buttons at the same time for the pump to remain operating. There is ship service air available to both systems and it is recommended that the ship service air system be used whenever possible due to the high noise level that occurs when these pumps are in operation.

SHIP: USS SAGINAW (LST-1188)

OPERATING SUMMARY

The forward air blower silencer is showing signs of deterioration, most likely due to moisture standing within it. There is no check valve installed between the tank and the air blower. Installed instead is a gate valve. If this valve is open and the air is secured, a tank over flow condition will flood and contaminate the aeration system. It is possible for the operators to come in direct contact with raw sewage when either draining the air silence or, during the initial starting of the air blower where atomized is sewage released into the space when the relief valve lifts because of fluid in the aeration line.

SHIP: USS SAGINAW (LST-1188)

FROM: 19 Sept 78

WASTEWATER GENERATION DATA

TO: 21 Sept 78

SHIP STATUS In port - 210

TEST METHOD The wastewater volume was calculated by tank volume measurements and pump event counters were installed to count the number of discharge pump activations.

VOLUME REDUCTION ADJUSTMENT

Both soil and waste drains were diverted to the CHT tanks to establish a normal baseline. Three urinals to the after tank and two urinals to the forward tank were on constant flush.

DATA

DATE	FWD gal	AFT gal	TOTAL gal
19 September	20,900	20,700	41,600
20 September	15,400	18,630	34,030
21 September	25,300	17,250	42,550
AVERAGE			39,393
			gpcd - 188

Table 1

SHIP: USS SAGINAW (LST-1188)

FROM: 2 Sept. 78

WASTEWATER GENERATION DATA

TO: 4 Sept. 78

SHIP STATUS In port - 210 men

TEST METHOD Wastewater volume was calculated by tank volume measurements and pump event counters installed to count the number of discharge pump activations.

VOLUME REDUCTION ADJUSTMENT

Soil drains were diverted over the side. Waste drains diverted to the CHT tank to establish gray water generation rates.

DATA

DATE	FWD gal	AFT gal	TOTAL gal
2 September	5,500	4,140	9,640
3 September	5,500	4,830	10,330
4 September	14,300	690	14,990
AVERAGE			11,653
			gpcd - 55

TABLE 2

SHIP: USS SAGINAW (LST-1188)

FROM: 12 Sept 78

WASTEWATER GENERATION DATA

TO: 14 Sept 78

SHIP STATUS In port - 210 men

TEST METHOD Wastewater volume was calculated by tank volume measurements and pump event counters installed to count the number of discharge pump activations.

VOLUME REDUCTION ADJUSTMENT

Waste diverted over the side. Soil drains diverted to the CHT tank to determine soil water generation rates. Five urinals on constant flush (three to the aft tank, two to the forward tank).

DATA

DATE	FWD gal	AFT gal	TOTAL gal
12 September	5,500	15,870	21,370
13 September	4,400	16,560	20,960
14 September	4,400	17,250	21,650
AVERAGE			21,326
		gpcd	102

Table 3

SHIP: USS SAGINAW(LST-1188)

FROM: 8 Sept 78

WASTEWATER GENERATION DATA

TO: 10 Sept 78

SHIP STATUS In port - 210 men

TEST METHOD Wastewater volume was calculated by tank volume measurements and pump event counters were installed to count the number of discharge pump activations.

VOLUME REDUCTION ADJUSTMENT

The forward system was secured and all drains diverted overboard. Soil and waste drains were diverted in the after system to the CHT tank. Three urinals were on constant flush to the after tank.

DATA

DATE	FWD gal	AFT gal	TOTAL gal
8 September	secured	23,460	23,460
9 September	secured	20,010	20,010
10 September	secured	20,010	20,101
AVERAGE			21,160
			gpcd - 101

Table 4

SHIP: USS SAGINAW (LST-1188)

FROM: 5 Sept 78

WASTEWATER GENERATION DATA

TO: 7 Sept 78

SHIP STATUS In port - 210 men

TEST METHOD Wastewater volumes calculated by tank volume measurements and pump event counters installed to count the number of discharge pump activation.

VOLUME REDUCTION ADJUSTMENT

Soil and waste drains were diverted to the CHT tanks. In addition, the forward tank flushing line was accidently left running.

DATA

DATE	FWD gal	AFT gal	TOTAL gal
5 September	168,300	14,490	182,790*
6 September	176,000	23,460	199,460**
7 September	20,900	24,800	45,700***

Average FWD of 5 & 6 September - 172,150 gallons

Average total of 5 & 6 September - 191,125 gallons

* Flushing commenced at 1200
** Flushing secured at 1230
*** Soil & waste only

Table 5

SHIP: USS SAGINAW (LST 1188)

AVERAGE TANK GENERATION RATES
(Gallons Per Day)
COLLECTION METHOD

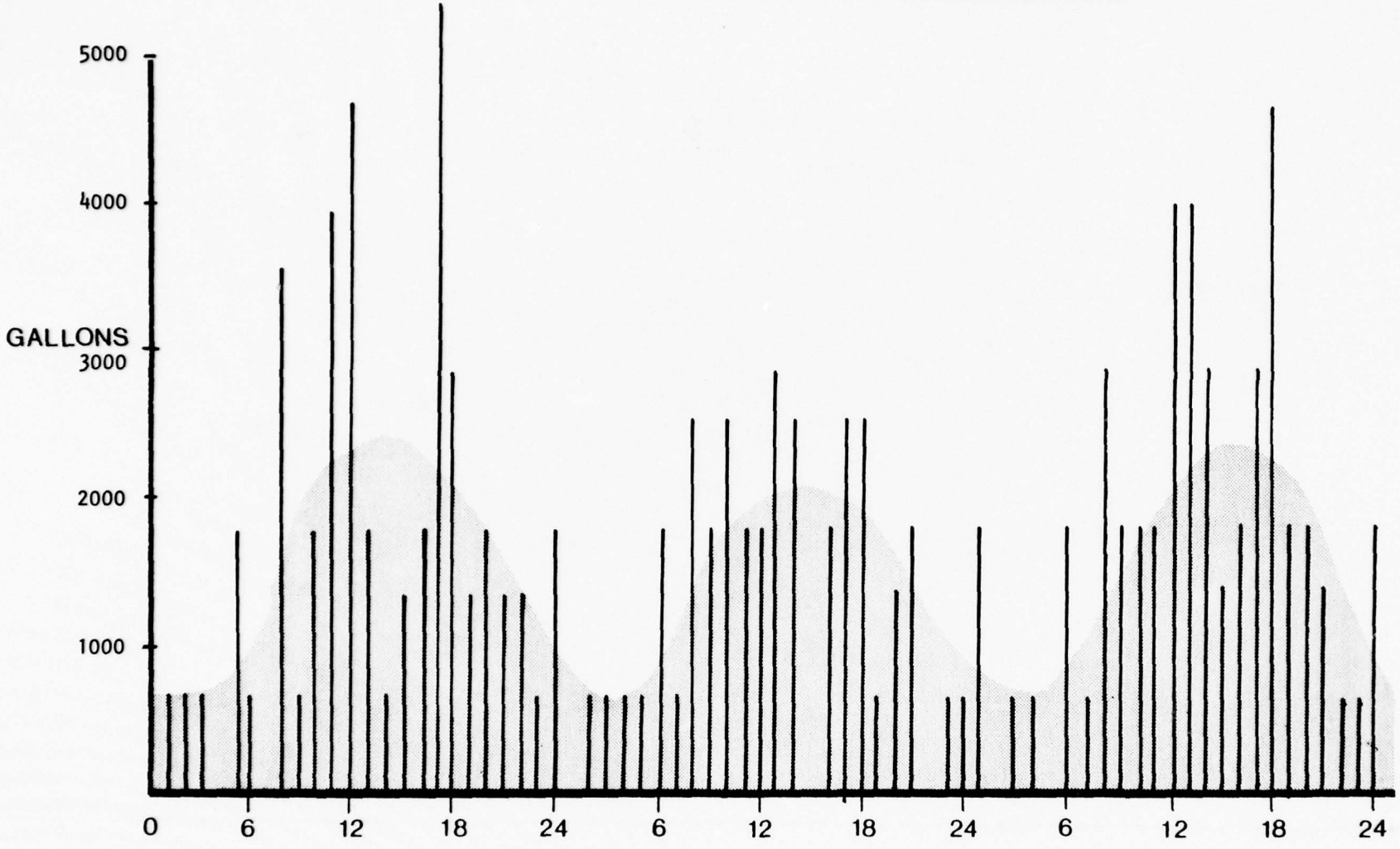
TANK	BASELINE (CONTROLLED)	GRAY ONLY	BLACK ONLY	BASELINE & FLUSHING
Forward	20,533	8,433	4,767	172,150
AFT	18,860	3,450	16,560	N/A
Both	39,393	11,653	21,327	N/A

TABLE 6

SHIP: USS SAGINAW (LST-1188)

FROM: 19 Sept 78

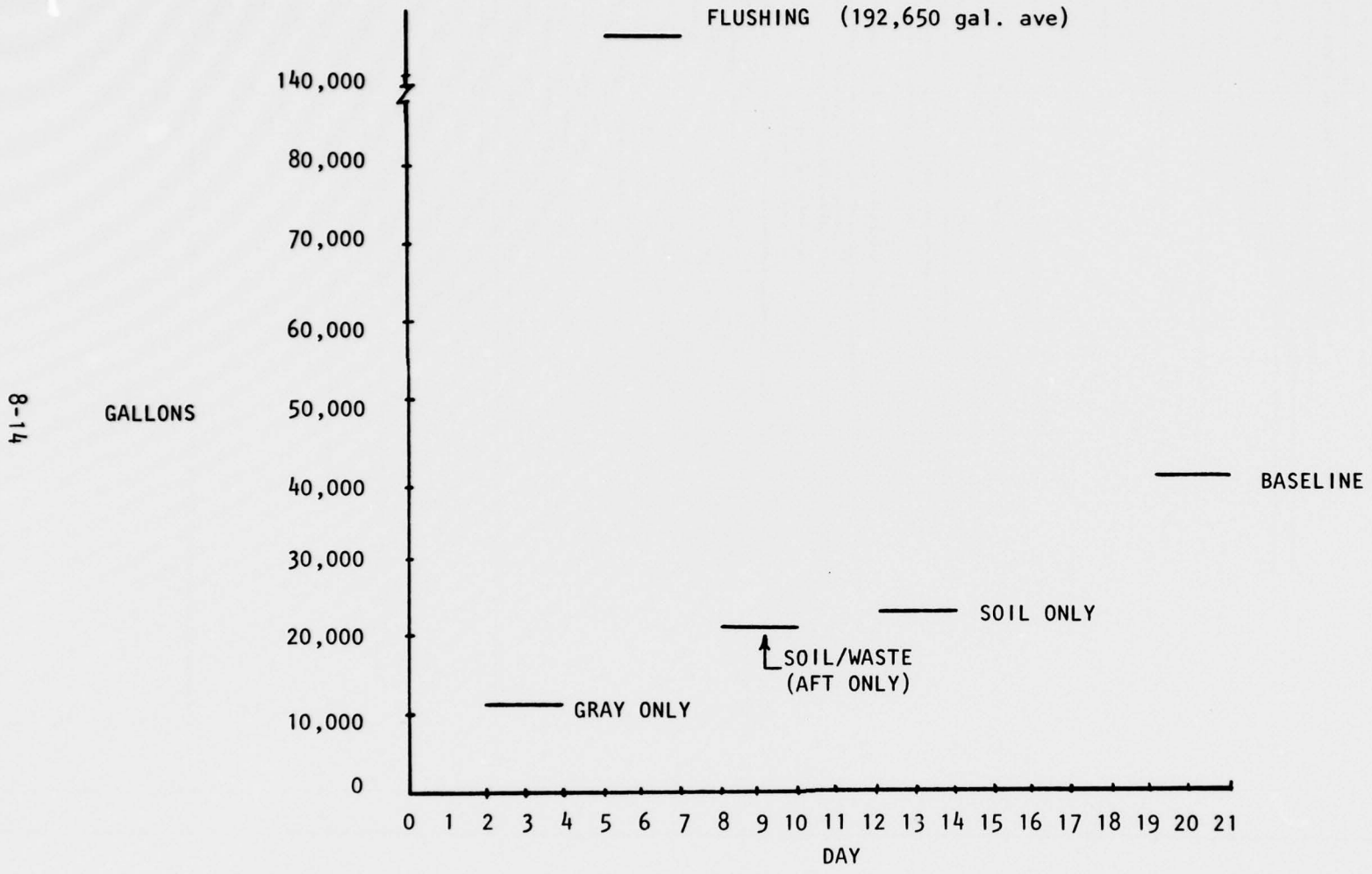
TO: 21 Sept 78



DIURNAL WASTEWATER GENERATION

FIGURE 1

SHIP: USS SAGINAW (LST-1188)



DAILY WASTEWATER GENERATION AVERAGE
FIGURE: 2

SHIP: USS SAGINAW (LST-1188)

CONCLUSIONS

The generation data for the USS SAGINAW was collected with the CHT System operating in different modes with the ship in port. The baseline data information was obtained by diverting all the soil and waste drains to the CHT tank where they were collected and pumped overboard. Soil data was collected by diverting the soil drains to the CHT tanks. Waste data was collected by diverting the waste drains to the CHT tanks. In addition, because of accidentally leaving the flushing line on into the forward tank, generation data was obtained which included the large volume of salt water caused by the constant flush. It was possible also to obtain additional baseline data for the after tank when the forward tank was secured because of an electrical power loss forward.

Tables 1-5 are presented to show the generation rates for the different modes of operation. Table 6 is included to show a comparison between average tank generation rates. It was possible to determine a minimum transit holding time for the SAGINAW from the data collected when only the soil drains were diverted to the holding tanks.

A baseline average of 39,393 gallons per day was obtained. This daily rate averages to 187 gpcd for a crew of 210 men. Table 1 shows three days of this data.

Table 2 shows the effect of diverting the soil drains over the side and collecting only the waste drains. An average of 11,653 gallons was collected over a three day period. Table 2 presents three consecutive days of waste collection. This averages to 97 gpcd.

Table 3 presents data collected with the soil drains diverted to the tank and the waste drains diverted over the side. During this phase, five urinals were found to be on constant flush. Three of the urinals were piped to the after tank and two of the urinals were piped to the forward tank. An average of 21,327 gallons per day was measured. This averages to 101 gpcd.

In Table 4, the data collected was baseline information for the after tank only. The forward tank was secured during this time because of a power loss. Again, three urinals were on constant flush to the after tank during this collection period. The after soil and waste drains were diverted to the after tank and were collected. An average of 21,160 gallons observed over this three day period is within the overall average for the after tank.

Table 5 shows the effect of a tank flushing line that was acci-

CONCLUSIONS

dentally left on for a 24 hour period into the forward CHT tank. The flushing commenced at noon on the 5th of September and was not discovered until 1230 on the 6th of September, a little more than 24 hours. The generation rate for the forward tank during this time was 8.4 times the amount that was normally realized in this tank. The data for the 7th of September shows approximately the normal generation rate for these tanks.

The wastewater collected during the baseline period is a total of all the gray and black water that was generated during this time. This includes all of the drains from the laundry, scullary, galley, and the heads and washrooms. When this gray water was collected, the laundry was secured. With the laundry secured, the forward CHT tank produced approximately 2.4 times the volume produced in the after tank. Based on experience and on the baseline generation data, with the laundry in operation, it can be expected that the forward tank will produce four times the amount of wastewater produced aft.

When only the black water was collected, the after system produced 3.5 times the volume of the forward system. The forward system is dedicated to collecting the troop personnel heads with the Officer and CPO heads also piped to this tank. The after system is dedicated to collecting crew personnel heads. During this test, the troop personnel were not embarked. The black water that was generated forward was from the Officer and CPO heads, plus the two urinals that were on constant flush in the troop heads. When the troops are embarked, it can be expected that the generation rate forward will increase approximately three times the rate that was seen.

The gallons per capita day (gpcd) generation from the different modes of operation on board the SAGINAW follow:

Baseline.....	187.6 gpcd
Black water only.....	101.5 gpcd
Gray water only.....	55.5 gpcd

Based on the data obtained when the tanks were collecting only soil drains and without troops embarked, the following holding times were determined. (The forward tank alarm rings at the 60% level because of the level sensor wiring modification):

SHIP: USS SAGINAW (LST-1188)

CONCLUSIONS

System	Generation Rate	Transit Time Until Alarm	Transit Time Until Overflow
Forward	119 gph	11.1 hours	18.6 hours
Aft	690 gph	2.8 hours	3.3 hours

The CHT tanks collected the following volumes for each duty pump cycle:

DUTY VOLUME

Forward Tank..... 1100 gallons

Aft Tank..... 750 gallons

It can be expected that when the ship is transiting, most of the crew member personnel will be at their assigned stations. Based on this assumption, the 690 gph of the after system could possibly be greatly reduced; therefore, increasing the transit holding time. The holding times for the forward and after tanks can be considered as the minimum time that a ship will have for holding.

SHIP: USS SAGINAW (LST-1188)

RECOMMENDATIONS

The daily generation of sewage by the SAGINAW, as collected by the CHT system, is excessive for normal operations. The wastewater is almost three times the 60 gpcd guidelines set forth for this system. Contributing to this high generation rate were five urinals, two to the forward system and three to the after system, that were found to be on a constant, no restriction flush. Also contributing was the high gray water generation rate of the ship's laundry. The high laundry generation rate was also seen in the FAIRFAX COUNTY, another NEWPORT class LST, and seems to be a class problem.

A recommendation in reducing the generation rate of the SAGINAW is to reduce the volume of flushing of the urinals on constant flush. A total securing of the constant flush reduced the black water generation on board the SAGINAW by 48%. The securing of the constant flush is not possible because of the scale build up in the drain piping. The flushing is required to prevent and control the scale formation in urinal drain piping. At present, no flushing guidelines are available. Each ship has to determine the amount of flushing they required.

The laundries on NEWPORT class LST's have been identified as high gray water producers. The operators of the laundry should be made aware of the effect that inefficient use (i.e.--small individual loads versus one large, full load) has on the wastewater generation of ships. It should be possible to regulate the amount of water required per load to operate the laundry machines efficiently. Consideration could be given to diverting the laundry drains over the side during periods of excessive generation to reduce the amount of wastewater pumped to the shore system.

The CHT system should be used whenever possible. Experience has shown that this system may be difficult to activate after being secured for extended periods of time. Contributing to the "start up" difficulties are sludge formation because of improper lay-up procedures and/or improper tank aeration, level sensor failures and general corrosion problems. If the system is to be laid up, proper lay up procedures should be followed. NSTM chapter 593 and the CHT system Technical Manual provide these procedures

The aeration system on board SAGINAW is installed in such a way that there is no check valve installed to prevent back flow from a full CHT tank into the aeration lines. Installed instead is a gate valve. This valve is an ideal isolation valve, but if the tank overflows and the air system ceases to operate, the isolation valve has to be secured manually

to prevent a sewage back flow into the aeration system. An additional check valve should be installed to provide this protection.

The air blower silencers should be drained regularly. There is evidence of corrosion in both silencers because of standing water. Care should be taken to ensure the entire aeration system is drained prior to activating the air blowers. This is to prevent the possibility of introducing atomized sewage into the pump room when the relief valves lift.

The aeration system must be used whenever the CHT system is in use. There is sufficient ship's service LP air available to be used in port. During transit, the air blowers should be used because of the ship control requirements for the ship's service LP air.

There are high level alarm circuit problems within each pump room, as were earlier discussed, and these should be repaired as soon as possible to prevent undetected overflow problems. The alarms do ring at the remote stations (Main Control and the Quarterdeck). The alarm system must be activated whenever the CHT system is in use.

The following additional modifications should be considered to enhance the CHT system's operation and maintenance:

1. A remote high level alarm should be installed in the Log Room since this space is manned constantly while in port and acts as DC central while underway.

2. Since there are two power sources in the pump control panel (main power and alarm power), a warning sign should be attached to the front of the control panel.

3. An indicator light should be installed on the control panel to show the status of the panel.

4. Identify the tank flushing valves as "Circle X-Ray" (Ⓧ) valves which are to be secured when not in use to flush the tanks. Experience has shown that leaving these valves open greatly increases the wastewater generation of a ship. Indicating the valves are to be secured when not in use will aid the operator in using the system.

SHIP: USS RECOVERY (ARS-43)

PORT: Norfolk, Va.

DATE: 5 Oct **TO** 8 Oct 78

SHIP CLASS DIVER class ARS

CHT SYSTEM Strainer type
1 system amidships with two discharge risers amidships
Peabody-Barnes pumps rated @ 150 GPM at 50 feet head
115 volt DC motors and controller
Mercury float level sensors

CERTIFICATION
Pending ship confirmation letter

OPERATING STATUS
Holding tanks and pumps operating as of 5 October 1978

INSTALLATION **DATE** March 1978
YARD Metro Machine, Norfolk, Va.

CREW SIZE **AT SEA** - 90
IN PORT - 90

TANK SIZE 30% - 231 gal.; 85% - 924 gal.; full - 1155 gal.
Duty Pump Volume - 51 gal.

SHIP: USS RECOVERY (ARS-43)

TEST PREPARATION

The USS RECOVERY (ARS-43) was boarded on 5 October, 1978 to activate the installed CHT system and to gather data on the sewage generation rates for the system. The system was relatively new, having been installed in March, 1978. The system had not been used to collect and transfer sewage.

Initially, the pumps, controller, level sensors, valves and associated equipment were inspected for proper operation. No initial discrepencies were noted.

The system was then activated using a constant flush of the CHT tank for three hours. This was to determine the reliability of the pump control circuits. During this phase, the duty pump was discovered to be running past the 10% pump securing level. An investigation revealed that the "4CR" control relay (pump securing relay) was the cause of the problem. The two set screws that secured the movable contact plate to the electromagnet switch had come loose and had fallen out, leaving the pump securing switch inoperative. The screws were replaced and the system operated satisfactorily.

Gray water was diverted to the CHT tank for collection by the CHT system. The gray water drains were inspected for signs of back-ups; no back-ups were noted. The system was aligned to pump over the side for a 24-hour period.

The RECOVERY was part of a two ship nest with the USS VULCAN (AR-5) that was set up to check the nest pumping procedures used in the Norfolk area. Sewage hose was passed from the VULCAN and made up to the RECOVERY's deck riser. The system was then diverted so that the RECOVERY would pump into the VULCAN's CHT receiving risers and tank to be later pumped ashore by the VULCAN's transfer pumps. Gray water only was used for these tests. Soil drains were diverted over the side.

Electrical event counters were installed to record the number of pump firings. The information recorded was used to determine the sewage generation volume of the RECOVERY.

SHIP: USS RECOVERY (ARS-43)

SYSTEM REPAIRS

VALVES & PIPING: None

ELECTRICAL The "4CR" control relay (pump securing switch) set screws on the moveable contact plate worked loose and fell out making the relay inoperative. The screws were replaced and the relay operated correctly.

LEVEL SENSORS None

PUMPS None

ALARMS None

SYSTEM DOCUMENTATION: Pressure, health, and operating placards are in place. PMS coverage has been requested, but is not on board. SDOSS is being developed.

SHIP: USS RECOVERY (ARS-43)

OPERATING SUMMARY

The RECOVERY's CHT system operates normally in the automatic mode for transfer to the shore in the shore sewers. There are no operating peculiarities in this system. The diverter valves are accessible and are easy to operate. There is pump through capability available.

The control panel and operating circuits are 115 volts DC. There is no local circuit breaker for the control panel in the pump room. The power must be secured at the main switchboard in Main Control.

The alarm circuit is 115 volts AC and is energized in Main Control. The alarms sound in the pump room, Main Control and on the Quarterdeck. The audible alarms can be silenced at each station. There is no automatic reset when the level drops below 85% in the holding tank. The alarm circuit requires resetting manually after each activation.

All laundry, galley,and garbage grinder drains are piped to the holding tank. The urinals are not on constant flush.

The discharge pumps on the RECOVERY are of a sufficient size to pump into a ship like the USS VULCAN. Care should be taken when pumping through another ship because of the pump discharge head limit of 50 feet. The RECOVERY is a low profile ship and has difficulty pumping through a high profile ship.

The check valves in the RECOVERY's sewage transfer system are capable of preventing back flow into the RECOVERY's CHT tank when other ships in the nest are pumping.

SHIP: USS RECOVERY (ARS-43)

FROM: 7 Oct 78

WASTEWATER GENERATION DATA

TO: 8 Oct 78

SHIP STATUS In port - 90 men

TEST METHOD Wastewater volume was calculated by tank volume measurements and pump event counters on each pump. Flow meters were used to check the calculated tank volumes.

VOLUME REDUCTION ADJUSTMENT

The CHT system was diverted to collect all gray water drains. Black water was diverted over the side.

DATA

DATE	NO. PUMP FIRINGS	TOTAL GAL.	GPCD
7 October	26	1326	14.7
8 October	26	1326	14.7

SHIP: USS RECOVERY (ARS-43)

CONCLUSIONS

The data collected on the RECOVERY is for the waste drains only. The soil drains remained diverted over the side and were not collected during this test period. The reason for leaving the soil drains diverted over the side was to prevent any accidental raw sewage spills while conducting the nest hook-up and pumping tests with the USS VULCAN (AR 5). Later soil drain volume collections were not possible because of the RECOVERY's requirement to get underway for scheduled operations.

Two days of gray water data were collected and are presented in Table 1. The number of pump firings is high, but the volume pumped is low. This is because of the small volume pumped from the tank (51 gallons) per pumping cycle. When the system is put into full operation collecting all waste and soil drains, the pump firing rate will increase greatly.

The volume of sewage pumped per pumping cycle is below the designed pumping volume. The 51 gallons pumped is only 5% of the tank volume. This low volume is due to the placement of the 10% and 30% level sensors. There are only three vertical inches between the levels where the sensor switches close. At the 10% level sensor there is 180 gallons of fluid remaining in the tank. At the 30% level sensor there is 231 gallons of fluid in the tank. The 30% level sensor should be placed higher to make it possible to pump a greater amount of sewage (at least 166 gallons) out of the holding tank.

The remaining 180 gallons is more than 10% of the tank volume. There are no provisions to aerate the fluid in the tank and septic conditions will occur. There are no provisions to pump the tank below 5% of the tank volume because of the installed suction piping design. The operator cannot remove the 10% level sensor for repairs because the fluid level remaining in the tank after pumping down with the "MAN 1" mode is above the access opening for the level sensor. To remove the 10% level sensor, the operator must remove the tank cover (located in a berthing compartment) and manually pump the tank down.

Electrically, the 115 volts DC is adequate to operate the CHT system. During the operation of the controller, only a small amount of arcing was observed. The only operating difficulty was that there was no local power supply circuit breaker in the pump room.

The RECOVERY is capable of nesting with other vessels. A pump through capability is available. The isolation check valves aboard the RECOVERY prevent back flow into the CHT tank when another vessel is pumping. The transfer pumps aboard the RECOVERY are capable of pumping to another vessel. Care should be taken when attempting to pump through because of the limited pump discharge head.

SHIP: USS RECOVERY (ARS-43)

RECOMMENDATIONS

Because of the small amount of fluid pumped during a pumping cycle, consideration should be given to placing the level sensors at heights in the tanks to allow for a larger pumping volume during the duty pump cycle. Further consideration should be given to modifying the suction piping so that it will be possible to lower the tank fluid to a level below the 10% level sensor access so maintenance or repairs can be accomplished easily on that sensor.

A local power source circuit breaker should be placed within the pump room. The only circuit breaker for this system is located on the main switch board in Main Control. This should be regarded as a SAFETY discrepancy as now designed.

In addition to the above, the following should be considered to enhance the operation of the RECOVERY's CHT system:

1. An indicator light should be installed on the control panel to give an "OFF/ON" status of the control panel.

2. Since there are two power sources in the control panel (main power and alarm circuit),a warning sign identifying the sources should be attached to the control panel door. The warning sign now attached does not identify the sources.

SHIP USS VULCAN (AR-5)
NEST : USS RECOVERY (ARS-43)

PORT: Norfolk

DATE: 6 Oct **TO** 8 Oct 78

SHIP CLASS	VULCAN class tender - nested with DIVER class rescue salvage vessel
CHT SYSTEM	VULCAN - comminutor type with receiving piping and separate comminutor - twin system. RECOVERY - strainer type with 150 gpm pumps @ 50 feet head - single system
NEST CONNECTION	Required 225 feet of collapsable sewage transfer hose and 90-degree elbow.
CREW SIZE	VULCAN - 767 RECOVERY - 90

SHIP: USS VULCAN (AR-5)
USS RECOVERY (ARS-43)

TEST PREPARATION

The USS VULCAN (AR-5) and the USS RECOVERY (ARS-43) were selected as test ships for nested sewage transfer as the result of last minute cancellation of a previously scheduled nest. With these two ships, test data was limited by the one pump room configuration of the RECOVERY and the deployment of the two ships immediately following the test series.

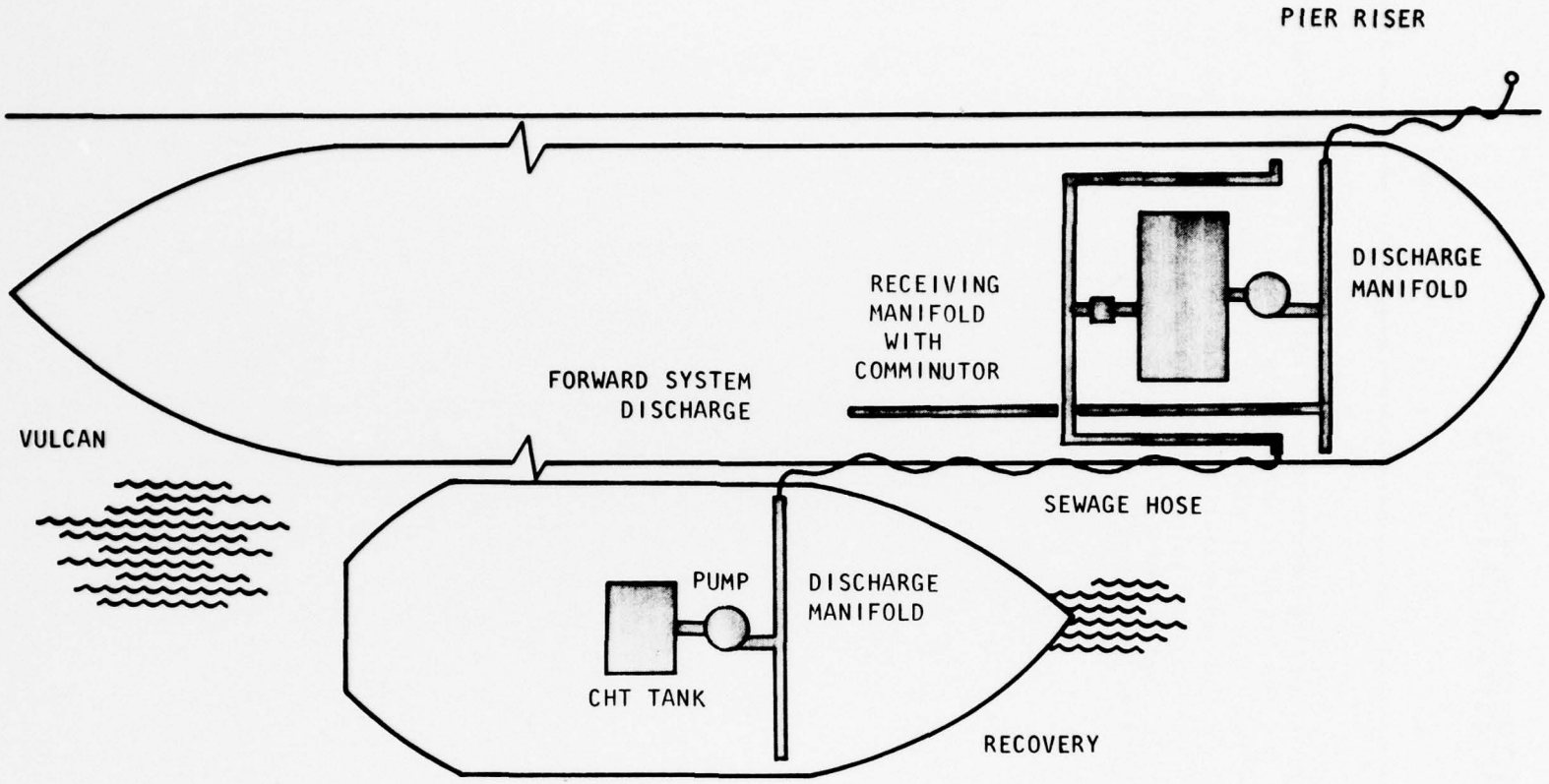
The VULCAN provided the opportunity to test for both the receiving and holding sewage transfer mode as well as the pump through mode. The testing could also examine the ability of a low profile ship, the RECOVERY, to transfer sewage into and through a high profile ship.

The VULCAN has two deck risers aft, one for the deck discharge riser and the other for the receiving riser, to accept sewage from ships alongside. The receiving riser goes directly into the VULCAN's CHT tank through a comminutor grinder. With the two riser arrangement the receiving capability and pumpthrough capability of the VULCAN could be tested. A schematic of the test configuration is shown in Figure 1.

The RECOVERY was moored somewhat forward of amidships on the VULCAN with its deck riser amidships. It was decided for the test to run additional hose length to the aft riser of the VULCAN rather than to the closer forward VULCAN receiving deck riser. Two hundred twenty-five feet of flat, collapsable sewage transfer hose was used to make the connection from the RECOVERY deck riser to the receiving risers of the VULCAN. The hose was delivered by the PWC hose reel truck and transferred by inter-connected lengths to the fantail of the VULCAN. As the hose was lifted up to the deck, it took four men to drag the lengths of hose along the outboard deck to make the connection to the RECOVERY. A 90-degree elbow was borrowed from PWC to simplify the connection of hose to the horizontal deck riser of the RECOVERY. Two additional 90-degree elbows were used on the discharge deck riser of the VULCAN to make a 180-degree return bend from the riser to the sewage connection hose. The sewage transfer hose was laid along the outboard rail on the passageway deck. Because of several obstructions along the passageway, the hose crowded the walking space and would not be satisfactory for long term use.

A flow meter was first placed on the deck of the VULCAN between two lengths of sewage transfer hose. This arrangement proved unsatisfactory because of the inability to acheive full-pipe flow with the collapsable sewage hose. The meter was moved to the deck riser of the RECOVERY where full pipe flow could be acheived and more consistent readings taken. Sound powered phones connected the RECOVERY pump room, deck riser and the VULCAN deck riser as well as the VULCAN pump room.

SHIP: USS VULCAN (AR 5)
USS RECOVERY (ARS 43)



NEST SCHEMATIC

FIGURE: 1

SHIP: USS VULCAN (AR-5)
USS RECOVERTY (ARS-43)

TEST PREPARATION

Wastewater recording meters were installed on the pump controllers of the VULCAN and the RECOVERY while ships were in the nest. The wastewater data was taken on the VULCAN primarily to examine the effect of cooler weather on the wastewater generation. Previous wastewater measurements on the VULCAN showed extremely high wastewater volumes produced because of high air conditioner cooling water loads. The wastewater taken from the RECOVERY is presented in the RECOVERY report section.

SHIP: USS VULCAN (AR-5)
USS RECOVERY (ARS-43)

OPERATING SUMMARY

The VULCAN has four deck risers, two each side, to receive sewage from ships alongside. An additional deck riser on each side aft is used to discharge sewage to shore sewers. The receiving deck risers have a separate four-inch pipe to each pump room through a separate comminutor into the CHT holding tank.

Sewage transfer hose is most easily brought aboard the VULCAN from the PWC hose reel and hauled onto the fantail deck by four men and carried to the deck riser stations. This hose can be laid on deck for long term use, or hung overhead on brackets.

Both CHT tanks are capable of receiving sewage from vessels alongside through independent deck receiving risers. If possible, the aft CHT tank of the VULCAN should be used rather than the forward tank, because of the high wastewater volumes collected by the forward tank. The aft tank has about one quarter the flow of the forward tank.

By using the aft discharge riser there is an option to pump through the VULCAN rather than into the holding tanks. However, tests have shown that low-profile, outboard ships with small discharge head pumps, have difficulty in pumpingthrough the internal piping of the VULCAN. Restrictions in the internal discharge piping of the VULCAN are caused by several sharp elbows and three to four-inch piping diameter changes and sludge build-up in the unused portion of the discharge piping. If the flow rate from outboard ships is insufficient, the receiving deck riser and piping system should be used.

SHIP: USS VULCAN (AR-5)

FROM: 5 Oct 78

WASTEWATER GENERATION DATA

TO: 9 Oct 78

SHIP STATUS In Port - 767 men on 5 & 6 Oct
Duty Sections 7,8 & 9 Oct

TEST METHOD Volume measured by pump event counter and mini-graph recorder. Counting duty volumes pumped

VOLUME REDUCTION ADJUSTMENT
None - remeasure of baseline during cooler weather.

DATA

DATE	TIME PERIOD	FWD gal	AFT gal	TOTAL gal
5 October	9.5 hrs	57,600	14,880	72,480
6 October	24.0 hrs	139,200	33,480	172,680
7 October	24.0 hrs	124,800	30,690	155,490
8 October	24.0 hrs	103,200	32,550	135,750
9 October	13.8 hrs	60,000	13,950	73,950
			24 hr. avg.	153,700
			1 hr. avg.	6,400

Because of frequent pumping the daily volume is higher to account for constant tank inflow. The corrected daily volume is: 24 hr. average = 203,000 gallons.

SHIP: USS VULCAN (AR-5)
USS RECOVERY (ARS-43)

CONCLUSIONS

The most obvious lesson to be learned from the nesting of the VULCAN and RECOVERY is the relative simplicity of the inter-ship sewage transfer connection.

1. The most complicated procedure is the hose handling operations in moving hose from the shore to the outboard ship. This procedure was handled easily by four men moving the inter-connected 225 feet of hose from the fantail along the port deck. On the shore, a powered hose reel was used to pay out, the lengths of hose to the ship. However, so far as the ship crew is concerned, it makes little difference whether the hose is delivered by a hose reel or from uncoiled lengths of hose laid out on the pier deck.

   Once the hose was laid out to connect the two ships, the rest of the procedures were easily handled by two men. The receiving ship, the VULCAN, was ready to receive sewage once the hose was connected to the receiving riser and the stop valves in the pump room were opened to allow direct pumping into the CHT tank. The VULCAN's receiving system has an independent comminutor installed on the receiving piping system. By using the receiver piping little deck to pump room communication is required. The outboard ship can connect and begin pumping at any time once the valves are opened.

2. In using the flat collapsable sewage transfer hose, it was essential to have 90-degree elbow adaptors available from PWC to facilitate the connection, avoiding kinking of the hose. This adaptor provided a straight connection to the horizontal deck riser of the RECOVERY.

   Sound powered phone communication between the two ships was not necessary because of the simplified receiving arrangements on the VULCAN and good visual communication between the two ships.

3. The RECOVERY was able to pump into the receiving piping of the VULCAN at a minimum rate of 80 gallons per minute and a maximum, with two pumps, of 120 gallons per minute. These rates were against 35 feet of vertical head and 225 feet of collapsable hose plus about 250 feet of internal ship piping.

CONCLUSIONS

TABLE 1

PUMPING RATES OF USS RECOVERY
INTO USS VULCAN RECEIVING RISER

TEST RUN	NUMBER OF PUMPS	RATE	PRESSURE PSI
1	2	120	8
2	1	80	6
3	2	110	8
4	1	90	6.5
5	2	100	8
6	1	80	7

4. An additional test was performed with the discharge hose from the RECOVERY connected to the outboard discharge deck riser of the VULCAN discharge piping into the shore sewer, by-passing the CHT tanks. Because of the high wastewater volumes generated on the VULCAN, this arrangement would lessen the VULCAN's wastewater pumping load. The discharge piping was flushed with the salt water flushing main prior to connection. However, pumping tests showed no flow, and a RECOVERY deck pressure of 10 PSI was measured. A second test was made by opening the check valves on the VULCAN to see if the RECOVERY could pump into the CHT tank through the VULCAN's transfer pumps. In this test the pumping rate from the RECOVERY was 40 gallons per minute, one third of her maximum pumping rate, into the receiver line of the VULCAN. The tests showed that the RECOVERY was unable to pump through the VULCAN directly to the pier sewer.

CONCLUSIONS

The discharge pumps of the RECOVERY were limited to approximately 60 feet of shut-off head. This available head was consumed with the vertical rise getting up to the VULCAN deck riser, the 225 feet of collapsable rubber hose between the two ships and the 50 feet of collapsable sewage transfer hose between the pier and the VULCAN.

TABLE 2

PUMPING RATES OF USS RECOVERY
INTO USS VULCAN DISCHARGE RISER (PUMP THROUGH)

MODE	NUMBER OF PUMPS	RATE GPM	PRESSURE PSI
ALIGNED FOR DIRECT PUMP THROUGH TO PIER	2	0 *	10
INTO VULCAN CHT TANKS THROUGH OPEN CHECK VALVES	2	40	8

*Blockage occuring in discharge riser.

While the RECOVERY was trying to pump through the VULCAN, as shown in Table 2, the pressure at the deck riser of the RECOVERY, 14 feet below deck riser of the VULCAN, was 10 PSI, or approximately 23 feet of available head. This means that there should have been nine feet of available head remaining at the top of the deck riser of the VULCAN. This nine feet, or 4 PSI, may have been further reduced from pressure losses in expanding the collapsable sewage transfer hose both between the ships and the connection between the VULCAN and the shore.

CONCLUSIONS

TABLE 3

USS VULCAN DISCHARGE PUMPING RATES

PUMP ROOM	VOLUME gal	TIME min	RATE GPM
FWD	2400	8.8	273
AFT	930	2.5	372

5. A typical hourly gallon average of sewage pumped by the VULCAN is 6,400 gallons. In using the pumping time shown in Table 3, it can be expected that the VULCAN will be pumping for 21.7 minutes every hour on a 24-hour average.

6. The two ships could be disconnected without the use of an air blow down fitting as long as there was no catenary of sewage hose between the two ships. The hose could be drained by opening the highest camlock fitting on the VULCAN and bleeding air into the line and draining back through the check valves on the RECOVERY. Flushing of the line was accomplished by salt water fire main flushing from the RECOVERY pumping into the holding tanks of the VULCAN pump room to flush out the receiving sewage lines. There is also a check valve at the receiving deck riser which also prevents the flushing of the line from the VULCAN. It will always be the outboard vessel's responsibility to flush the sewage transfer hose.

7. The wastewater data of Table 4, taken on the VULCAN, shows a five day average of 153,700 gallons per day. This is a 30% reduction from the June 28th baseline measurements of 220,000 gallons per day. The reduction is the result of lower air condition cooling water load in the cooler fall weather. (Note: the corrected volumes, to allow for the high CHT tank loading rates, are: 203,000 gallons per day (Oct. 9 average); 314,000 gallons per day (June 28 average).) The correction method and curve is discussed in the July 18th transmittal letter.

SHIP: USS VULCAN (AR-5)
USS RECOVERY (ARS-43)

RECOMMENDATIONS

As a result of nested ship testing, the following recommendations are made for the VULCAN to receive sewage from a nested ship alongside:

1. All sewage transfer hose should be provided from shore Public Works Utilities Department while at domestic ports. The onboard supply of sewage transfer hose should not be used. A hose transfer operation from the pier to the outboard ship is easily and quickly accomplished with approximately four men manually raising the hose onto the fantail and dragging the hose lengths along the outboard deck. After this procedure remaining connections can be made with two men. Four men are again required in lowering the hose to the pier after disconnecting.

2. The sewage receiving system should be used where the sewage is pumped into the VULCAN's CHT tanks by the outboard ship rather than pumping through the VULCAN's discharge piping. The receiving lines have a separate comminutor to chop the received sewage before entering the holding tanks. The aft tank and receiving system of the VULCAN is preferred over the forward system because of the excessive wastewater load on the forward tank on the VULCAN.

3. Sewage hose connections must always be made to the receiving ship, VULCAN, before connecting to the outboard ship. This will prevent spills from an unanticipated pumping prior to making the final connection.

4. The outboard ship is responsible for flushing the sewage transfer hose. Once this is accomplished, after ten minutes of flushing, the hose is considered clean and can be re-used or returned to the shore facility. Hose caps and plugs should be obtained from the Public Works Utility Crew to prevent any draining on the deck.

5. The receiving line comminutor must be secured soon after the outboard ship has been disconnected. The comminutor will run hot without the cooling provided by the sewage.

6. If the VULCAN will be receiving sewage from an outboard nested ship on a regular basis, hose brackets should be installed to support the sewage hose off the passageway deck. These brackets will keep the passageway clear and the hose tucked up underneath the overhead.

7. Ninety-degree elbow camlock connectors are useful in preventing kink in the collapsible sewage transfer hose. These are available from

RECOMMENDATIONS

Public Works Utility Department and should be used liberally where necessary to prevent kinking from sharp hose bends.

The following recommendations should be considered for inclusion in the NAVSEA Tech Manual 593, or as design changes:

8. All sewage transfer hose and fittings should be provided by the shore side activity, and not stored or maintained by the nested ship or tender.

9. The simplest way to transfer hose to the outboard ship for tender-ship connection is manually with at least four men in the hose-handling crew.

10. Adaptor fittings, such as elbows, are best provided by the shore side activity. These fittings are essential to prevent excessive kinking of the sewage transfer hose. The shore side activity should be encouraged to make sufficient fittings available to the ships. The 90-degree elbow camlock adaptor fitting can be connected in various combinations to provide most any desired angle or direction change required.

11. While outboard ships are pumping into or through a high profile inboard ship, they should be aware of the pumping limits of the transfer pumps. Available pump head is quickly reduced by the collapsible sewage transfer hose, the height of the highest deck riser in the system, and the restrictions of internal ship transfer piping. The nest of the VULCAN and RECOVERY was an example of a high profile inboard ship and a low profile outboard ship with low head transfer pumps. This nest represents an extreme situation and the problems in transferring through an inboard ship would not be expected with ships having 70-foot head transfer pumps as are installed in most destroyer type systems.